Grinding and Finishing

WHEELS • GRINDING • HONING • LAPPING MACHINES • ACCESSORIES • PORTABLE GRINDERS • TUMBLING • ABRASIVES

a hitchcock publication

The Magazine Devoted Exclusively to Abrasive Operations

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DETROIT

★ FEATURES

Precision Grinding and Lapping At Sundstrand Aviation

Diamond Dressing Tools At Plymouth

Lubrication or Cooling?

Polishing Stainless

Possibilities of Double Disc Grinding

ALSO IN THIS ISSUE

Shop Hints and Kinks

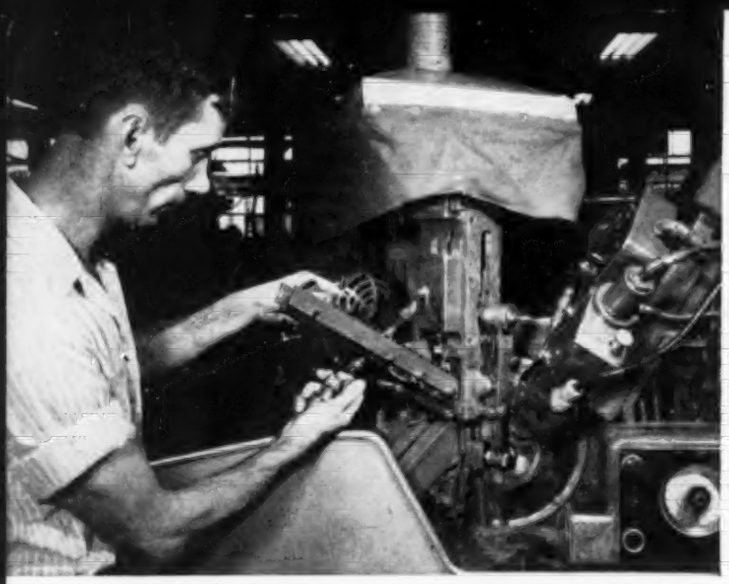
Safety

Letters to the Editor

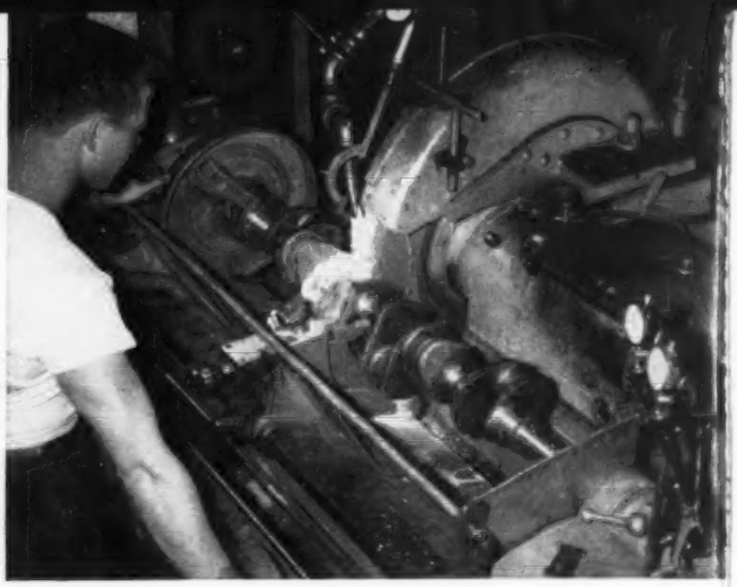
Free Literature

What's New in Equipment and Materials

MAY 1956

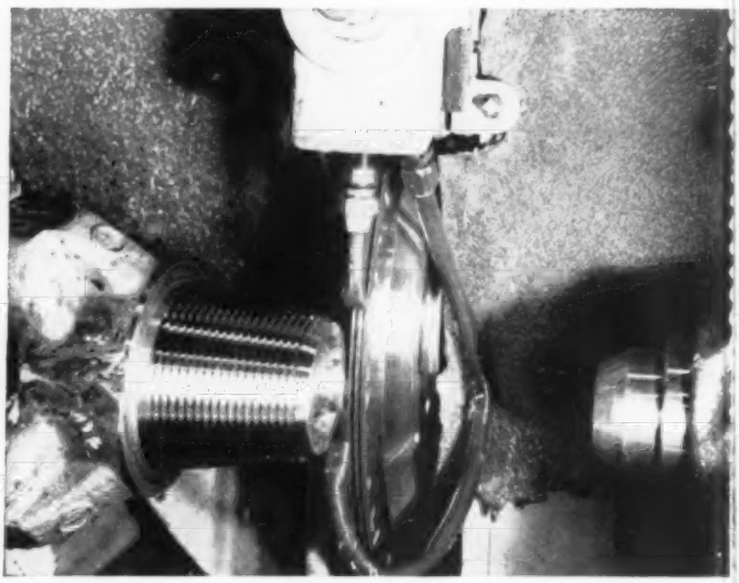


GRINDING BEARING CONES on micro-centric grinder. Since using *Texaco Cleartex Oil* as both grinding oil and machine lubricant, operator reports he can get twice as many pieces with better finish.



CRANKSHAFT GRINDING with emulsion of *Texaco Soluble Oil* as coolant. Fine results in finish, rust prevention, emulsion stability and cleanliness reported.

Better finish
Fewer dressings...
Lower costs...



THREAD GRINDING is a one-pass operation here, using a multi-rib diamond dress wheel and *Texaco Grindtex Oil 411*. Excellent wheel performance, highly accurate thread form, fine finish, long oil life and low operating cost are benefits reported.

SHOWN are three typical examples (names on request) of the better grinding that results when the Texaco grinding fluid recommended by Texaco Lubrication Engineering Service is used.

There is a complete line of *Texaco Cutting, Grinding and Soluble Oils* to help you do all your machining better, faster and at lower cost. A Texaco Lubrication Engineer will gladly recommend the proper ones for your jobs.

Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Circle No. 311 on postpaid card

TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

MAY, 1956—VOL. 2, NO. 1

Grinding and Finishing

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EDITORIAL STAFF

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List of Hitchcock Representatives on Page 111.
Subscription rates: $6.00 per year in U.S.A. $7.50 per year elsewhere.

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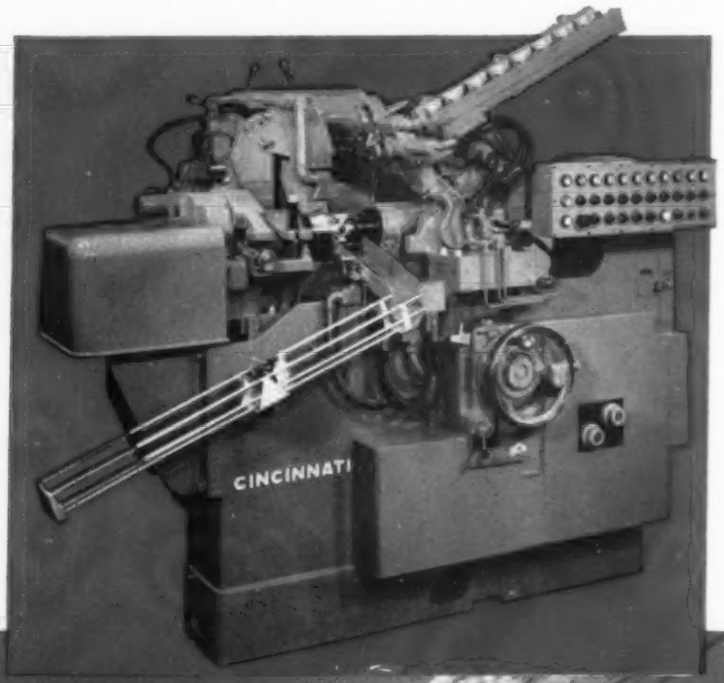
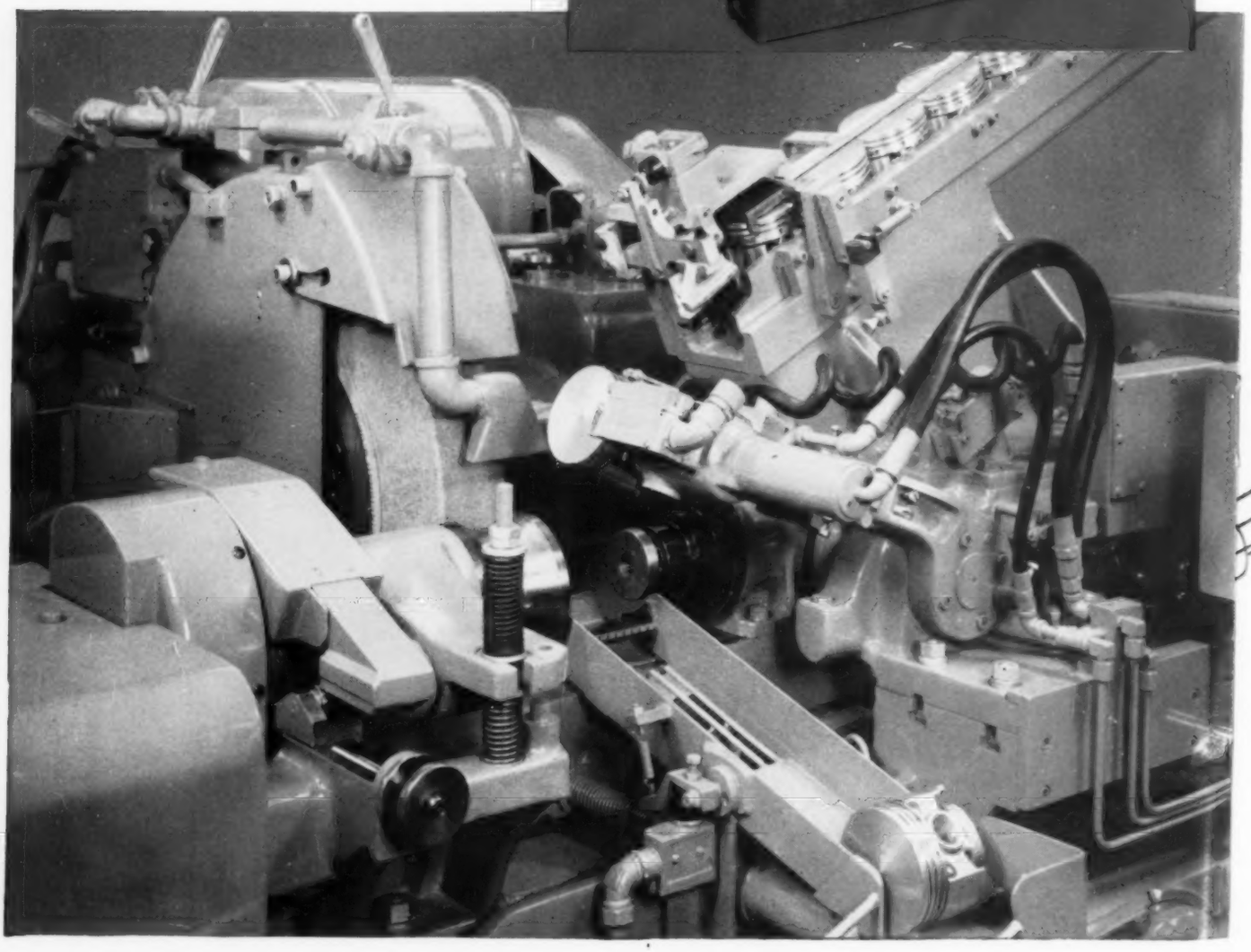
Accepted as controlled circulation publication at Pontiac, Illinois

Fully Automated Cincinnati

Grinds 130 automotive

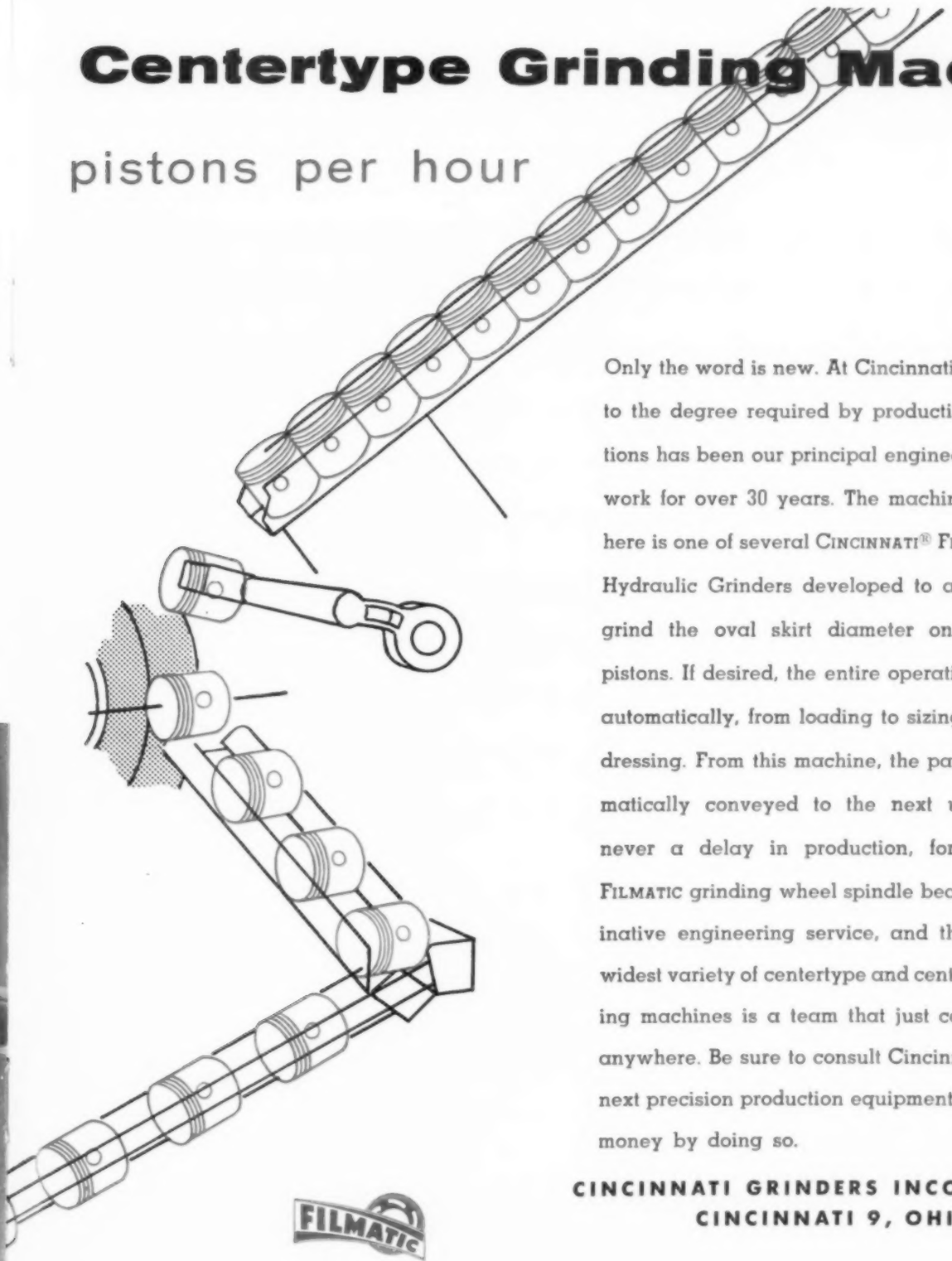


Oval skirt diameter is ground on 130 pistons per hour, on this CINCINNATI® FILMATIC Automatic Centertype Grinding Machine. Close-up shown below.



Centertype Grinding Machine

pistons per hour



Only the word is new. At Cincinnati, automation to the degree required by production specifications has been our principal engineering service work for over 30 years. The machine illustrated here is one of several CINCINNATI® FILMATIC Plain Hydraulic Grinders developed to automatically grind the oval skirt diameter on automotive pistons. If desired, the entire operation proceeds automatically, from loading to sizing and wheel dressing. From this machine, the parts are automatically conveyed to the next unit. There's never a delay in production, for CINCINNATI FILMATIC grinding wheel spindle bearings, imaginative engineering service, and the industry's widest variety of centertype and centerless grinding machines is a team that just can't be beat anywhere. Be sure to consult Cincinnati for your next precision production equipment. You'll save money by doing so.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

FILMATIC

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

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For accurate, economical production on your centerless grinding machines . . .

CORTLAND CENTERLESS GRINDING WHEELS

Made to Order

Here at Cortland, this phrase means just what it says. We welcome tough grinding problems because our engineers can find ways to solve them and a problem solved means a customer satisfied.
May we help you?

Centerless grinding is one of the important factors enabling "the wheels of industry" to turn smoothly. Shafts, bearing races, rollers, rods, pins, etc. are ground to exacting tolerances when wheels are *right for the job.*

You'll find wheel-making at its best in Cortland Centerless Grinding Wheels. They hold shape, yet cut freely for rapid and accurate production with minimum dressing.

You can secure Cortland Grinding Wheels in the *exact* combination of abrasive grade and structure for the material to be ground, stock to be removed, finish required and tolerances specified.

And once *your* Cortland wheel specification has been established, you can reorder with perfect assurance that each succeeding lot will be exactly like those which have given you such satisfactory performance.

Popular sizes — 20 x 4 x 12, 20 x 6 x 12 and 24 x 6 x 12 — in standard markings are carried in stock. Other gradings and/or sizes can be produced quickly to order in regular "A" or "FA" Oxaluma (aluminum oxide) or "C" Carbora (silicon carbide) in either vitrified or resinoid bond.

CORTLAND **CORTLAND GRINDING WHEELS CORP.**
Chester, Massachusetts

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PAN AMERICAN
Grinds holes plus 0.0003", minus 0.0000"
on RIVETT
Magneto Bearing Support. Bearing size is 1.3749" dia. Tolerance is plus 0.0003", minus 0.0000".
Rivett Model 1024 Internal and Universal Grinder. Double-end wheelhead swivels 180° for quick conversion. Holes to 9" dia., external to 12" dia. Collets mount directly in workhead spindle.

Maintenance contributes to Pan American World Airways System's excellent reputation for safety and dependability.

At the Latin American Division Overhaul Base in Miami, Fla., Pan American has been using a Rivett Model 1024 Internal and Universal Grinder on small hole work for 3½ years.

Pan Am states: "*The Rivett Grinder is in operation during two eight-hour shifts per day, five days per week. The only service has been lubrication and replacement belts. It is considered the most accurate and productive universal grinder in the shop. We have another machine on order.*"

This testimony to Rivett accuracy and productivity has company in similar statements by other Rivett users. Write for Bulletin 1024B and get the details of how Rivett can improve your toolroom and small lot grinding.

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Rivett Lathe & Grinder, Inc.
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Send Free 12-page Catalog 1024B.

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RIVETT

A Symbol of Accuracy in Machine Tools

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HOUGHTO-GRIND

Oil-Free Chemical Grinding Compound Prevents Wheel Loading, Fights Rust

Houghto-Grind keeps finishes free from grinding cracks and burns caused by wheel loading because Houghto-Grind's high detergent action keeps grinding wheels clean. Freshly ground surfaces won't rust because they are protected by Houghto-Grind's corrosion inhibiting properties. With Houghto-Grind, the operator can see the work 100 percent of the time. This fluid is absolutely transparent, enabling close and continuous observation when grinding to exact tolerances.

Easy to use, Houghto-Grind mixes with water at room temperature, providing a long-lasting, non-foaming, permanently stable solution. Because there is no oil in it, there is no disposal problem. It will not pollute streams or rivers. Even in periods of prolonged use, Houghto-Grind is free from rancidity or unpleasant odors. A special germicide retards the growth of living organisms that might cause poor health and safety conditions.

Your Houghton man will gladly give you complete details about how you can take profitable advantage of Houghto-Grind's efficiency, economy, transparency and rust-preventing properties. Call him today, or write E. F. Houghton and Company, 303 W. Lehigh Avenue, Philadelphia 33, Pa.

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HOUGHTON PRODUCTS FOR THE STEEL INDUSTRY • Hydraulic Fluids • Rust Preventives • Grinding Compounds • Special Purpose Lubricants • Heat Treating Materials • Cutting Oils and Bases • Leather and Synthetic Rubber Packings • Pickling Inhibitors

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Letters to the Editor

Chip Breaker in Drill Bushing

In your February, 1956 issue on page 47 you showed a chip breaker idea that looks good enough for us to try. Would it be possible to have more detailed information. . . .

Harding Van Schaack,
Methods Development Eng.,
Trackson Co.

In the February 1956 issue of your magazine there is an article by Mr. H. J. Gerber on grinding a chip breaker on bottom of drill bushing.

We are very much interested in this article and would like more information if possible. . . .

J. M. Buckley
United Shoe Machinery Corp.

Editor's note: We asked Mr. Gerber to clarify the explanation given in the February issue. He very kindly obliged with the reply and photo reprinted below.

". . . the enclosed photograph illustrates the chip breaker ground into the drill bushing.

This particular bushing has been reground several times and therefore the groove is larger than it originally was. The effective side of the bushing slot is cut in almost vertically and raked away from the hole in the bushing. (giving a positive rake to the cutting edge.—Ed.)

I have not done any experimenting to determine the most efficient angles or form but have simply ground these slots freehand using a dish wheel on the tool and cutter grinding machine."

H. J. Gerber, Assistant Prof.
Oklahoma Institute of Tech.
Stillwater, Oklahoma

Able Hands

Those "able hands" in your plant can better serve you when working with grinding wheels produced by Electro.

Able Hands soon discover that Electro provides grinding wheels which are unusually effective. These wheels are increasingly superior because of formulations which are created by capable technicians for each of your individual grinding applications.

Electro manufactures all types of vitrified and resin bonded grinding wheels. Experienced field representatives, located in all industrial areas, will be pleased to make specific wheel recommendations for your "able hands."

K-458

Electro Refractories & Abrasives Corporation

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Only Cutter Grinder in the WORLD with all these features

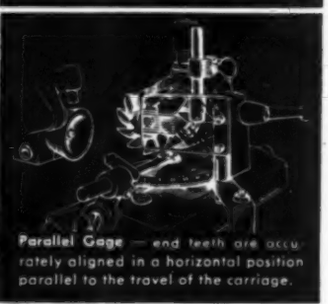
END MILL
CENTRA·POINT
GRINDER ®

Specifically designed for sharpening the small cutters that are so difficult to grind on large machines, CENTRA-POINT is fully described in Bulletin M-55.

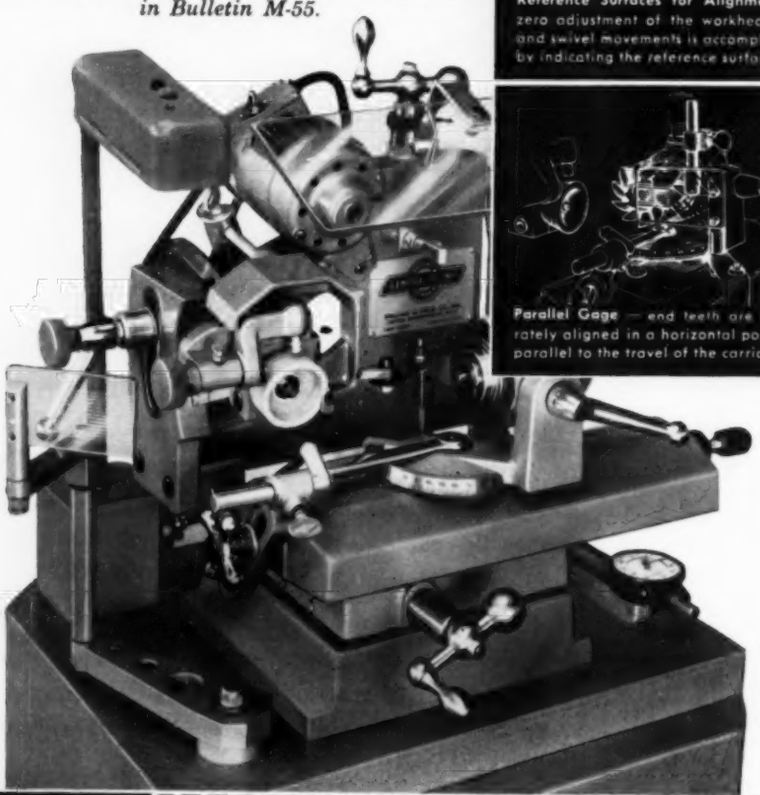
Clearance Angle Scale — clearance angles are read directly from a graduated scale on wheel spindle assembly.

Mechanical Wheel Dressing — an accurate radius is mechanically dressed on the grinding wheel, in correct relationship to self-registering tooth rests.

Reference Surfaces for Alignment zero adjustment of the workhead tilt and swivel movements is accomplished by indicating the reference surfaces.



Parallel Gage — end teeth are accurately aligned in a horizontal position parallel to the travel of the carriage.



FREE

CENTRA-POINT DIVISION
William H. Field Co., Inc., 331 Dorchester Ave., Boston 27, Mass.
Please send a copy of the new CENTRA-POINT Data Sheet.

Name _____ *Title* _____
(Please Print)
Company _____
Address _____
City _____ *Zone* _____ *State* _____

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Centerless Grinding

Will you kindly let us know whether reprints of the five-part series on Centerless Grinding are available and, if so, we would like to know the cost of these.

W. A. McCune
General Sales Manager
Norton Co. of Canada, Ltd.

We are very much interested in an article in the March 1956 issue of GRINDING & FINISHING. This article is entitled Centerless Grinding—Part 5, Causes and Cures of Faulty Grinding, Coolants, Truing and Dressing Wheels.

If you have any reprints of this article, it would be appreciated if you would send two copies to the attention of the writer.

M. C. Roberts
Asst. Plant Engineer
Crosley & Bendix Home Appliances Div.
Avco Mfg. Corp.

We have the March and February issues of your GRINDING & FINISHING and have been very much interested in the article on Centerless Grinding running for the past five months. Although several of our foremen receive this magazine monthly without charge, we are unable to put our hands on the January, December, or November issues.

Can you mail us several reprints of just this article, or, if not available, one copy each of the January, December, and November issues.

C. C. Fletcher
Purchasing Agent
Worcester Pressed Steel Co.

I am a production foreman in an industrial plant, and wish to get reprints of the articles in your magazine on Centerless Grinding.

Will you please inform me how I may obtain these reprints?

Charles R. Lambert

Centerless Grinding Reprints are now available at 35 cents a copy.

Cut-off and Flex Wheels

Please send me five copies of the article entitled "Are You Getting Your Money's Worth from Your Abrasive Cut-off Wheels?," which appeared in the March 1956 issue of GRINDING & FINISHING. If there is a charge for this material, please let me know.

Edwin G. Chapman
Plant Superintendent
Misco Precision Casting Co.

There are two articles which appeared in the March issue of GRINDING & FINISHING, that we feel are good reference articles and would be useful to our salesmen. If it is possible we would like to obtain 75 reprints of each of the articles.

The two articles are: The New Flex Wheels, by Jack Kenyon; and Are You Getting Your Money's Worth from Your Abrasive Cut-off Wheels?

Gene H. Fischer
Products Div. Advertising
Cincinnati Milling Products Div.

I would appreciate an extra copy of each of the articles entitled, "New Flex Wheels," by Jack Kenyon, and "Are You Getting Your Money's Worth from Your Abrasive Cut-off Wheels?" by John A. Mueller if this is possible.

I found both these articles very interesting and would appreciate a separate copy of each for my personal files.

R. H. Merritt
Abrasive Division
Norton Co.

Reprints are available on the Abrasive Cut-off Wheels article but as yet the Flex Wheels story has not been reprinted.

We Need Help

Our problem is the pointing of ends of hardened MB spring steel wire which we have been pointing by a hand grinding process. Our production is expanding and shortly this manual system will not be sufficient to meet our needs, plus the fact that an objectionable burr is frequently produced on the tip of the piece.

Therefore we are interested in obtaining a semi-automatic system for pointing the pins. That is, a unit which may be hand fed but the grinding and deburring will be done automatically. A production rate of 1,000 pieces per hour or greater is desired. The ends are not ground to a close tolerance. The length of the pin is 3" plus or minus 1/16". Material can be ground either before or after it is hardened.

If you know of a unit which would meet the above specifications we would greatly appreciate you forwarding the manufacturer's name. If a standard unit is not available, a special one might be designed if you would forward the name of the designer so that we might contact him.

J. R. Herzog
Smethport Specialty Co.

Anyone having any information that would be helpful to Mr. Herzog would be greatly appreciated.

Likes G & F

. . . May we state that each and everyone of us who are recipients of this magazine sincerely believe that not only is it very beneficial from the standpoint of articles . . . but also it is very appropriate for our type of products. We know from reports received that it is reaching the persons who use our products.

G. E. Westerholm
Director of Sales
Cortland Grinding Wheels Corp.

clear
transparent

K-7

NEVER LOADS THE WHEELS

K-7 solutions do not load work wheels, and this important advantage means (1) fewer dressings, (2) longer wheel life and (3) a true ground finish (rather than a burnished or smeared finish). In addition, with K-7 (because it does not load) you can often use a harder (1-2 grades) and finer (10-20 points) grit wheel, resulting in better work at lower cost.

Investigate K-7 for use in grinding all steels, cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. (Not recommended for non-ferrous metals.) It is an all-chemical water soluble liquid concentrate, transparent and colorless in solution. It is non-foaming and runs absolutely flat under all conditions. Low pH (alkalinity) makes it easy on the skin. Send for details.

CONCENTRATION TEST KIT

With this pocket size Concentration Test Kit K-7 users can check the concentration of the solution right at the machine. Only takes a minute or two.

THE Lusol LINE
BETTER PRODUCTS FOR BETTER METALWORKING

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GENERAL INDUSTRIAL
Diamond Products

Constantly increased sales of our products are the best testimony of their quality.

tools, hones, wheels, powder, loose diamonds

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"Honesty, Integrity and Service is our Motto"

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611-21 BROADWAY NEW YORK 12, N. Y.

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Standard Data

In the introduction to your series of articles on Standard Data for Grinding Machines by E. A. Cyrol, you mention an article or book written by the same author on "Standard Data for Turret Lathes."

We have found this series on grinding very interesting, and we would like to obtain copies of the Data for Turret Lathes. Do you know where this article can be obtained, or could you give us the address of Mr. Cyrol so we could write him directly.

J. P. Fisher
Supervisor, Time Standards
Dominion Engineering Wks.

We suggest you write directly to Mr. Cyrol, whose address is: E. A. Cyrol & Co., 120 S. LaSalle St., Chicago 3, Ill.

Electrical Discharge Machining

We are looking for suitable equipment to machine hard metals using method of submerged electro-discharge and vibration. We are also interested in the devices for removing broken taps and drills, which would operate on similar principle.

We would appreciate it if you would be kind enough to send us a list of manufacturers of such machines.

J. Kossowski
Precision Methods and Machines, Inc.

Information Sent.

Appearing in your January, 1956 edition of GRINDING & FINISHING, is an article by H. V. Harding, titled "Electrical Discharge Machining". We would very much appreciate a copy of this article, if it is possible.

Ralph N. Tozer
Sales Engineer
Production Broaching Corp.

Tear Sheets Sent.

Smoothness Standards

We have been receiving your publication for the last year and have found it very interesting.

We think you would be in a good position to tell us, or furnish us, a standard marking for drawings, as to grades of grind or lap finishes. (Micro inches or grind numbers.)

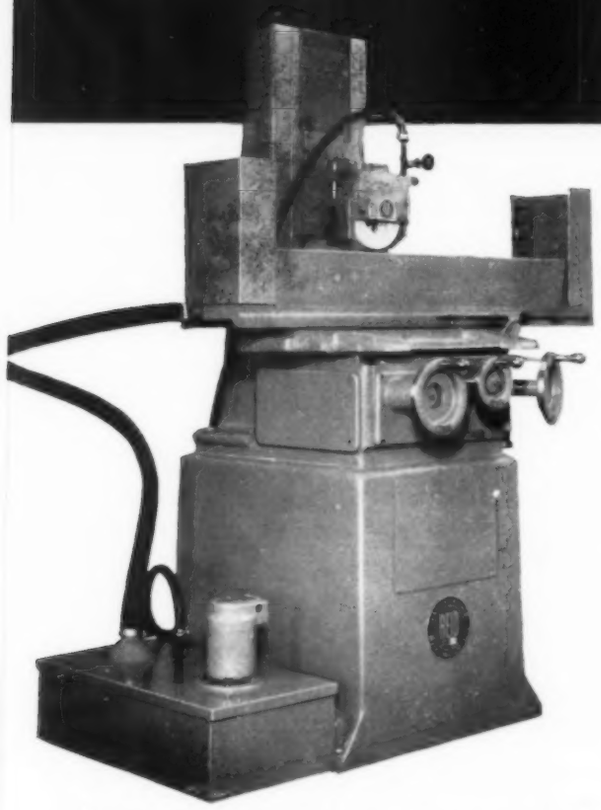
We have had apparatus with parts to be ground or lapped and would like some standard of smoothness.

E. L. Sinclair
Socony Mobil Oil Co., Inc.

We recommend two very good books on the subject and suggest you write to the following and ask for a copy.

"How to Specify Surface Roughness" booklet available from Micrometrical Mfg. Co., Ann Arbor, Mich., and "The Grinding Wheel" available from The Grinding Wheel Institute, 2130 Keith Bldg., Cleveland 15, O.

REID sets the standard for precision surface grinding...



MODEL 618H convenient finger-tip level controls for all operations make this grinder the favorite of the toolroom for the finest tool and die grinding. Accessories, including Cool-Grind or wet grinding attachments, magnetic chucks and form dressers give extreme versatility for all operations.

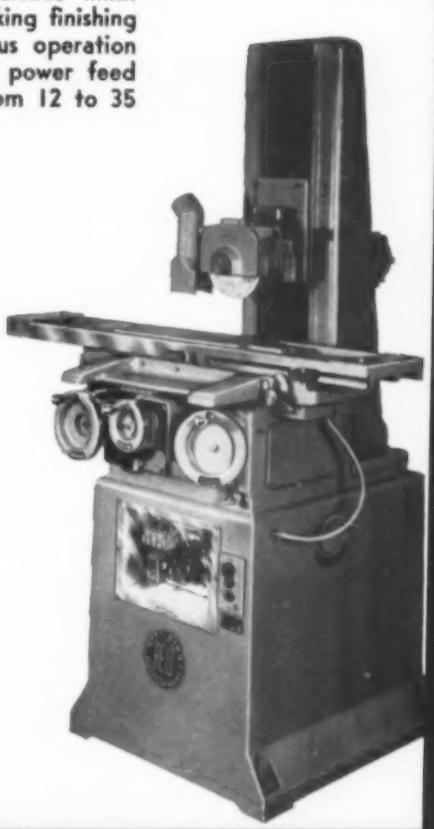
MODEL 618VL designed for precision grinding to the finest tolerances with superior surface finish . . . rugged construction and painstaking finishing give true dependability for continuous operation with minimum maintenance. Features power feed table with traverse speed variable from 12 to 35 feet per minute.

SPECIFICATIONS

CAPACITY: 6" wide, 18" long, 17¼" high from spindle center to table.
WORKTABLE: 51" x 8" overall.
FEED RANGE: Elevating hand wheel (r.) graduated to .0005" (optional, vernier to .0001"); cross feed to .001"; power cross feed adjustable .006" to .100" at either or both ends of table reverse.
GRINDING HEAD: with 3" opening for standard 1 h.p. cartridge type motorized spindle. Wheel size: 7" x ½" x 1¼".
FLOOR SPACE: 71" x 43½"
WEIGHT: 2100 lbs. net

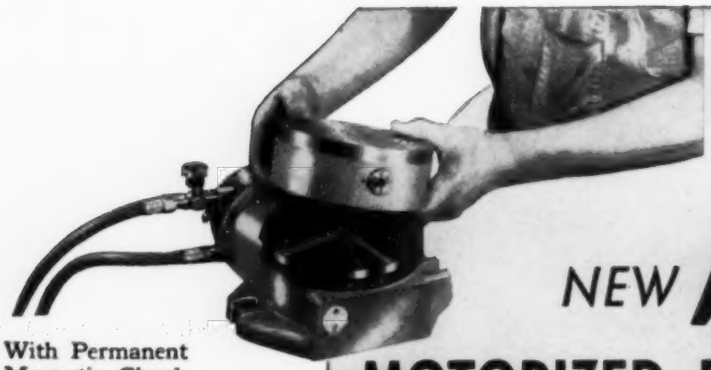
Write for Bulletin 618-18

Photo courtesy of Robertson Mfg., Co.



Reid Brothers Company, Inc.

BEVERLY MASSACHUSETTS

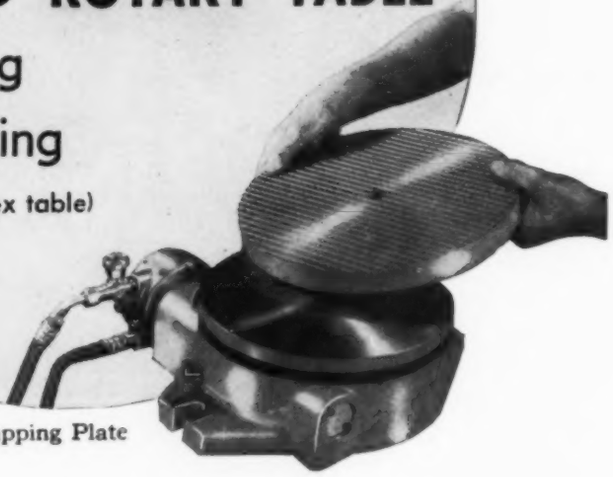


With Permanent Magnetic Chuck

NEW *Vulcan* MOTORIZED ROTARY TABLE

for lapping and grinding

(not an index table)



With Lapping Plate

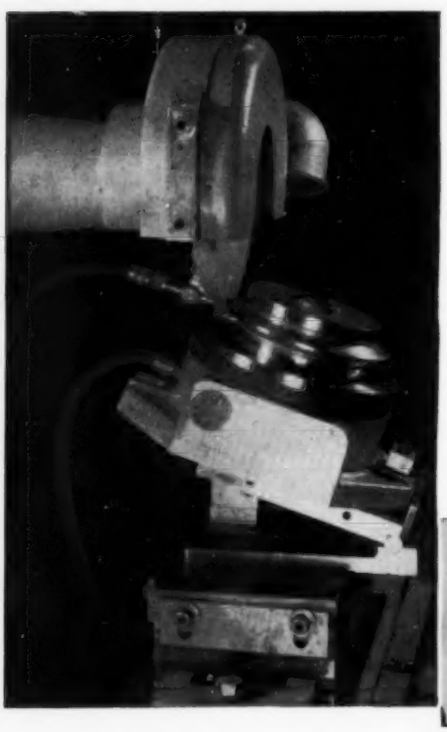
FASTER
circular precision grinding!

Now with this table and with less effort you assure highest standards of accuracy, flatness, finish and close tolerances. At the same time you eliminate slow and complicated tool setups. You cut grinding time greatly by using only cross feed while the table is rotating at infinite speeds between 40 and 100 RPM.

For example, Vulcan's Rotary Table can be used in connection with a sine plate or angle fixture. The dressing of large expensive external wheels for side grinding is therefore eliminated. If you wish we can provide permanent magnetic chucks designed for use with our table, both 6″ and 10″ in diameter.

Vulcan's Rotary Table is an air operated, self contained unit, portable between bench or machine. A precision center hole for locating and tapped holes in the table for clamping provides easy setup. Circular surface grinder applications are many and varied — grind flanged studs or bushings — bearing spacers — forming rolls — cutters — convex or concave surfaces — punches or dies (radius or angle).

Lapping? Yes — and in micro inches. For the 6″ and 10″ table, lapping plates of 12″ and 16″ are provided. Perfect for lapping valve plates, gages, bearing spacers and for carbide lapping using diamond powder. *Write for circular.*



Work clamped to motorized table, mounted on sine plate. Surface grinder application.

Major Vulcan Services

Engineering, Processing, Designing and Building . . . Special Tools . . . Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and size. Vulcanaire Jig Grinders . . . Motorized Rotary Tables . . . Plastic Tooling.

VULCAN TOOL CO.

744 LORAIN STREET • DAYTON 10, OHIO

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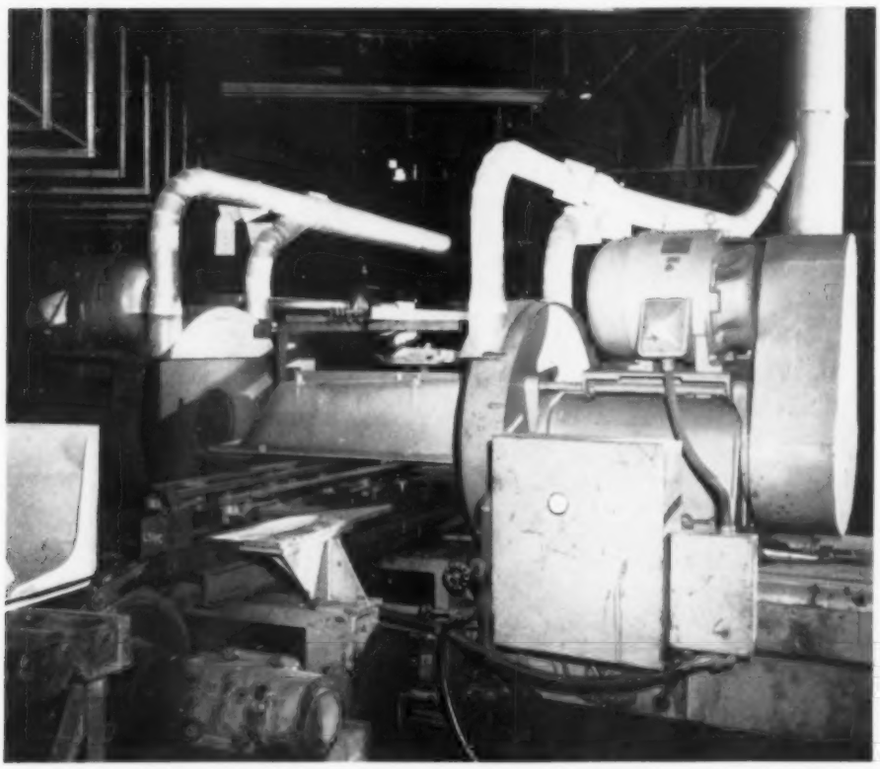
BESLY **Grinderscope**

NEWS AND VIEWS ABOUT WAYS TO CUT COSTS WITH MACHINES AND METHODS

FROM BESLY-WELLES CORPORATION, SO. BELOIT, ILLINOIS



After the backs have been ground on a Besly No. 226 Single Spindle Grinder, a conveyor in the cleaning room of The Crane Co., Chattanooga, keeps bath tubs rolling through for finish trim-grinding on both ends simultaneously on a Besly No. 626 Double Horizontal Spindle Grinder.

42" Besly-Titan abrasive discs, on both machines, grind to a tolerance of ±.010" for squareness and flatness.

Finishing Fixtures 30% Faster with Besly Grinders

at half the cost and half the waste!

One of the largest plumbing fixture manufacturing plants in the world, The Crane Co., Chattanooga Division, installed two Besly Grinders, in November 1954, for finish-grinding tubs, sinks and lavatories. One of these machines was the Besly No. 626 Double Horizontal Spindle Grinder, shown above. The other was the Besly No. 226 Single Spindle Grinder, shown on the next page.

Under the present production process, all fixtures come from the sand blast cleaning operation, pass through the grinding and go on to the enameling process by means of conveyor systems. After cleaning, they are all placed on the conveyor leading to the No. 226 Grinder. Sinks and lavatories require grinding on the back only. These pass through the No. 226 machine but by-pass the No. 626 machine. Tubs are ground on the back by the No. 226 unit and are transferred to a second conveyor at right angles to the first. This carries them through the No. 626 machine for the grinding of both ends simultaneously. The heads of this machine automatically position themselves to accommodate right hand, left hand, or various lengths of tubs at random.

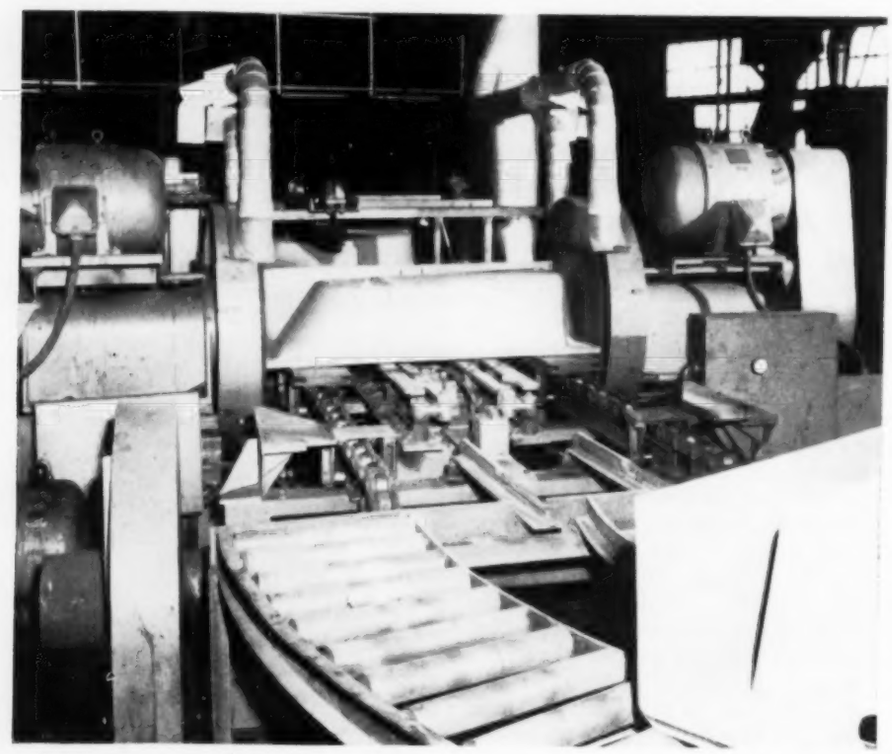
Prior to the installation of these modern Besly Grinders, the job was done with cumbersome swing-frame units. It was very hard work which required a six-man team to accomplish. At that time, these units merely snag ground the fins and gates of the lengths with no particular attention paid to squareness or flatness. Then, the Besly

continued next page

BESLY Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, So. Beloit, Illinois.

After sand blasting, tubs are guided through the No. 226 machine for back grinding. They are then transferred to the conveyor leading to the No. 626 machine for simultaneous end grinding.



Tubs pass through the No. 626 Grinder at the rate of 120 per hour. The conveyor carries them on to the enameling process.

Finishing Fixtures 30% Faster - (continued)

Grinders were suggested for this work.

After tests proving their ability to do a better, more accurate job, the Besly Grinders were set up in the cleaning room of the plant. Since their installation production has been increased from 84.4 pieces to 120 pieces per hour —a jump of nearly 30%.

Three men now handle the grinding whereas it formerly required six—releasing three men for other production. These grinding operators receive the same pay but have considerably easier and *safer* working conditions.

With one pass through the Grinders, ¼" of material is removed. Tolerances of ±.010" for squareness and flatness are now achieved which provide The Crane Co. with additional selling advantages. Waste is cut 50%, as well.

Two Besly-Titan 42" abrasive discs are used on the No. 626 machine and one on the No. 226 machine to provide complete unit-grinding in one pass. These grinding wheels have a life expectancy of 16,000 pieces with no dressing required.

Because of the 50% savings in labor and reduced waste, additional savings in abrasive equipment, plus the 30% increase in production—costs of this grinding operation for The Crane Co. were cut 50%.

It would pay you to get the facts on how Besly can save you time and money on your work. A bulletin describing the complete line of Besly Grinders for abrasive discs from 12" to 72" is available on request.

SEND COUPON ON BACK PAGE FOR FREE BULLETIN NO. 200

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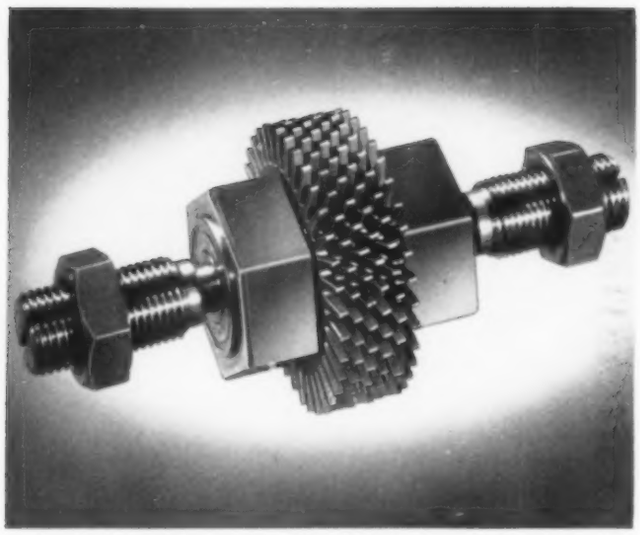
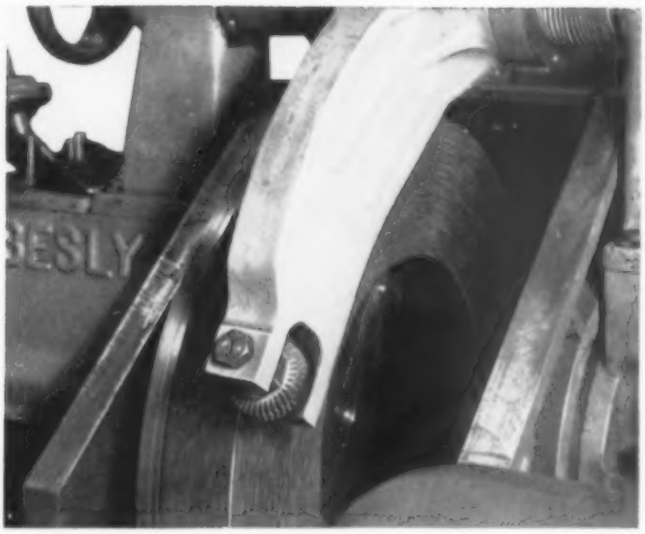


NEW "Wise Type" Besly 2½" Dresser Cutter Assembly for abrasive discs. Notice the "tru-square" arbor and slim "fingers" for PICK-ACTION DRESSING.



FITS ALL GRINDERS—The "Wise Type" Besly Dresser Cutter is interchangeable with 2½" cutters used on Besly Grinders; adaptable to other holders.

Better Dresser Performance at Lower Cost

The advanced functional design of the *new* Besly Dresser Cutter gives users superior dressing performance. It is easier to assemble, lasts longer and cuts, instead of crushes, the abrasive surface. These features, in addition to low initial cost, provide lower cost abrasive disc dressing.

Slim "fingers" *pick* abrasive grain from the surface of the grinding discs. This sharpens without changing the grinding characteristics. Other dressers often produce a disc that acts as though it were several degrees softer. These "fingers" require less pressure for more efficient sharpening, and last longer because there is less friction.

Another unique feature of the Besly "Wise Type" Dresser Cutter Assembly is the "tru-square" arbor. The square design overcomes one of the chief disadvantages of other cutters which tend to chew the keyway holding them on the arbor spindle and wear out the spindle long before the cutter itself is worn out.

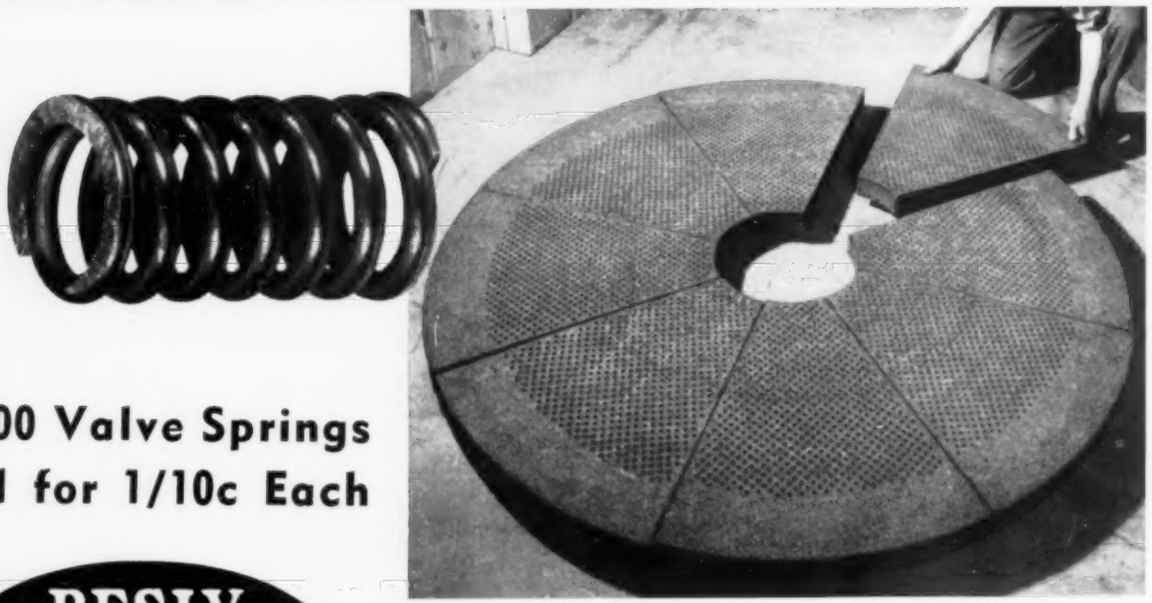
Almost frictionless rotation of the cutter assembly is assured by sealed ball bearings holding the square arbor. Buttons pressed into the side of each individual cutter eliminate the need for spacing washers, and speed assembly and replacement. Only six cutters are needed to make up a complete dresser cutter assembly.

Most users find that once they try the Besly "Wise Type" Dresser Cutter they keep on using them. We were so impressed with the performance of this new assembly that it is being installed as standard equipment on many of the Besly grinders now leaving our plant.

Try it yourself — get better dressing while reducing both arbor and dresser cutter replacement costs. The "Wise Type" Assembly fits all Besly 2½ inch dresser holders and is adaptable for machines of other makes. The price is only $8.25 each, about 15% below previous models. Send in a trial order, today!

BESLY Grinderscope

News and Views About Ways to Cut Costs with Machines and Methods from Besly-Welles Corporation, So. Beloit, Illinois



1,075,000 Valve Springs Ground for 1/10c Each

with BESLY TITAN

A leading producer, using a pair of 72" Besly-Titan Steelbac Abrasive Discs made with the new LH Bond, grinds over a million valve springs, both ends, for 1/10 cent each. Springs are 7 coils, 2-1/4" long, 11/64" wire and 1-3/8" O.D. This manufacturer claims these discs with LH Bond construction provide 1/3 more production than other types.

*Patented

LH BOND* ABRASIVE DISCS

NEW LH BOND STOPS LOADING and GUMMING, INCREASES WHEEL LIFE and CUTTING EFFICIENCY

The New LH Bond, now used in the manufacture of Besly-Titan Abrasive Discs and Wheels, is a new Resinoid base bonding agent. Such small amounts of this resin are needed to produce adhesion that tendency to "gum" or "slick over" from heat created in grinding is practically eliminated. This results in the prolonged life and increased cutting action.

Custom-made discs and wheels are supplied to fit your requirements. They can be produced with any desired characteristics—even very hard grades—without overloading with non-cutting elements. Lower abrasive costs and greater grinding efficiency are assured.

Why not get a trial run with the new LH Bond custom-made Besly-Titan Abrasive Discs or Wheels. They cost no more than "stock" types. We feel sure we can prove their time and money-saving, work-improving qualities to you. Ask us to run one for you.

NEW BULLETIN . . . *Get your free copy of Abrasive Disc and Wheel facts. Send coupon below.*

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ABRASIVES

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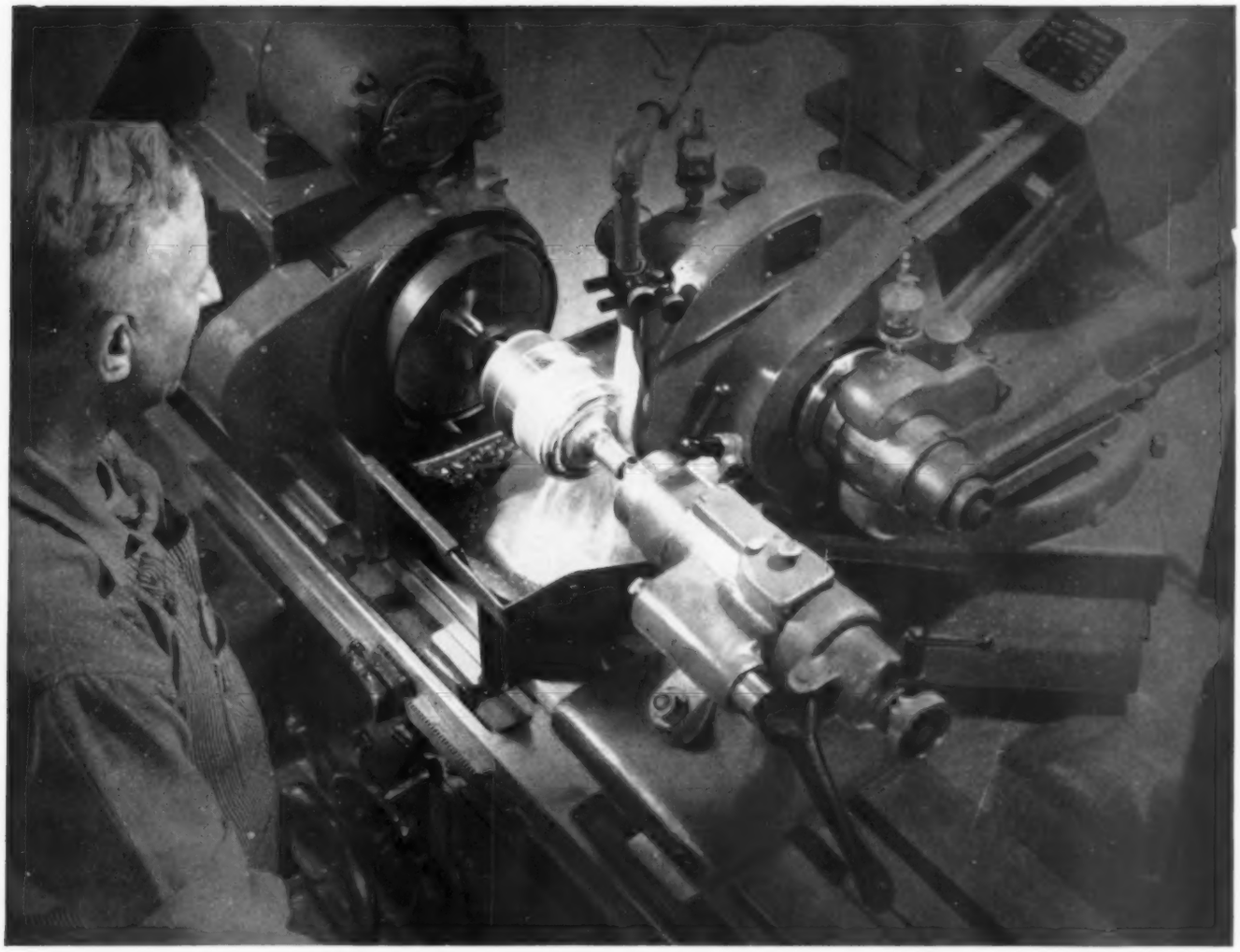
South Beloit, Illinois



High Speed Production Grinding DEMANDS more than just a Coolant!

High speed production grinding has made just *coolants* obsolete! Today's water-mix grinding fluid must provide lubrication, heat dissipation qualities, anti-rust protection and balanced surface tension. If you're using *"just a coolant,"* it's costing you extra money!

Stuart's CODOL is a carefully designed liquid grinding compound that is *far more than just a coolant*. CODOL has been scientifically compounded to provide far more detergency than ordinary water-mix grinding fluids. Wheel loading is greatly reduced and allows more pieces to be ground per wheel dressing.

CODOL's carefully balanced surface tension insures the carrying away of chips and abrasive particles from the wheel, work and machine. Surface finish is improved, production is increased and good wheel life is obtained.

To be sure that you consider *all* of the important points, such as ease of mixing, resistance to rancidity, gumming and foaming, when selecting a water-mix grinding fluid, ask "the Man in the Barrel," your Stuart Representative, to call and help you. And write today for your copy of the Stuart Water-Mix Cutting and Grinding Fluid book.

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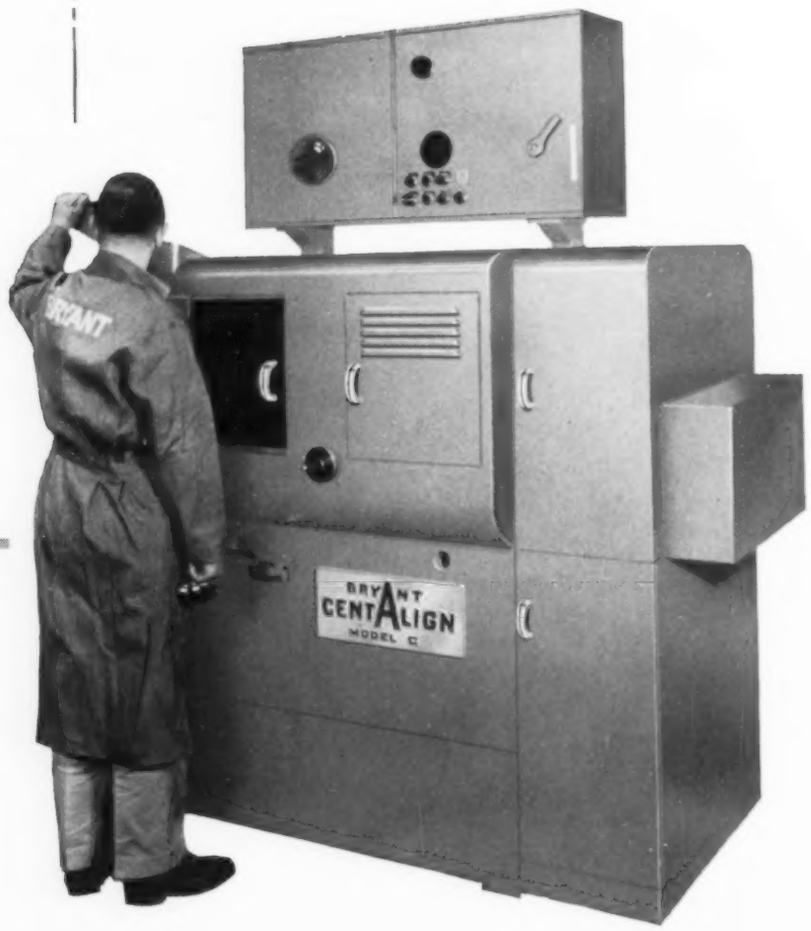

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Here is the machine you've asked for! The Bryant Centalign is specifically designed for the higher-production, lower-cost internal grinding of bearing raceways and taper bores, and for similar operations. It embodies the latest developments in shoe centerless grinding, and is adapted to automated lines. Ask for a demonstration.

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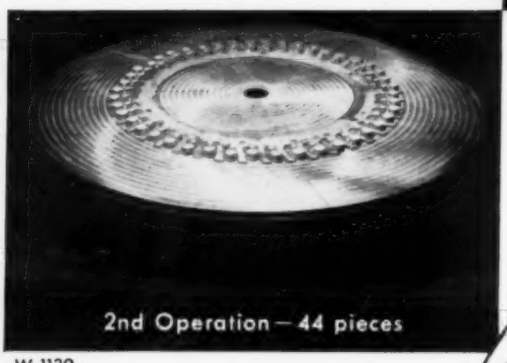
Another example

1st Operation—653 pieces

W-1138



2nd Operation—44 pieces

W-1139

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No. 303 Stainless Steel Forging

653 oddly shaped, non-magnetic workpieces

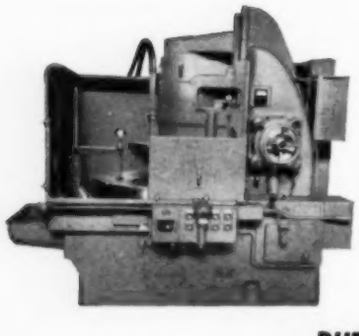
Blanchard Surface Grinders are noted for their unusual versatility—like grinding small, non-magnetic stainless steel forgings in quantity.

In the first operation, 653 forgings are loaded and blocked between rings on a No. 18 Blanchard, with 36" magnetic chuck (stock removal .010"). Parts, chuck and rings are sprayed with oil, and molten sulphur is poured around the parts to hold them. After grinding, the sulphur is easily stripped away.

This entire operation takes only 1½ hours—including preparation of the sulphur.

In the second operation, 44 pieces are set in a notched steel ring. Tilting the wheelhead and maintaining wheel pressure in one direction holds these non-magnetic pieces in the notches. Stock removal from this surface is .030", to tolerance of ±.003. Each load takes eight minutes—floor-to-floor.

As a result of this ingenious workholding, each piece is ground on both sides in a fraction of a minute, at less than 98¢ abrasive cost for all 653! That's typical of the convenience and economy of grinding on a Blanchard—whether the parts are magnetic or non-magnetic!



Send for free copies of "Work Done on the Blanchard", 4th edition, and "The Art of Blanchard Surface Grinding", 3rd edition—recently revised.

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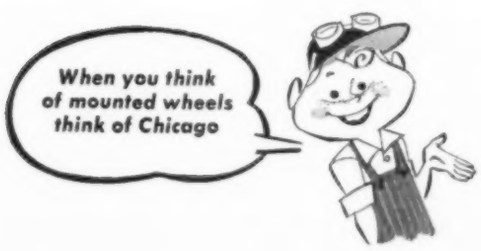
GUARANTEED to stay on their mandrels. They are perfectly balanced, easily dressed, and hold their shape.

SAVE TIME, MONEY, MATERIALS using Chicago Mounted Wheels. There is almost an infinite number of combinations of dimension, shape, grain size and bond.



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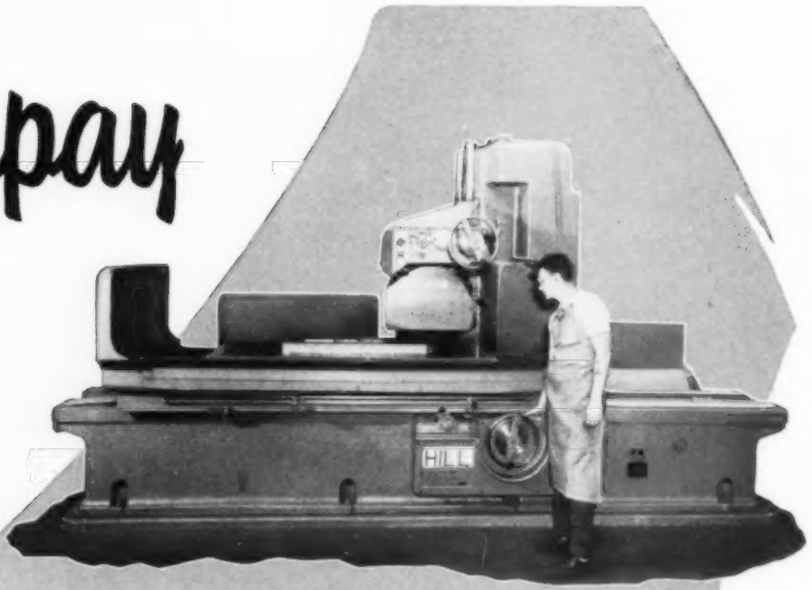
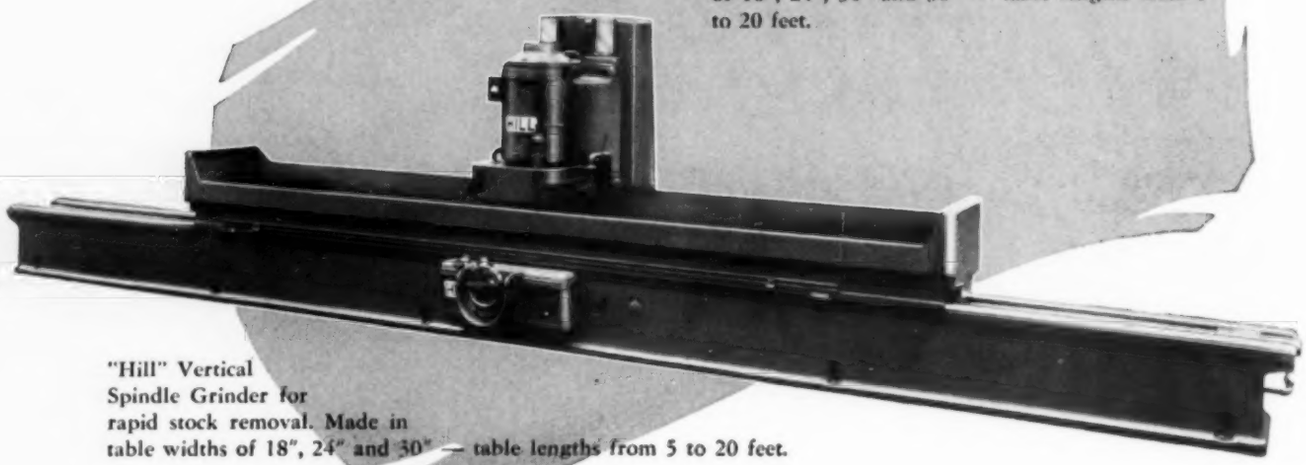
It should pay you too!



"Hill" Horizontal Spindle Grinder for a wide range of precision grinding. Made in table widths of 18", 24", 30" and 36" — table lengths from 5 to 20 feet.



"Hill" Vertical Spindle Grinder for rapid stock removal. Made in table widths of 18", 24" and 30" — table lengths from 5 to 20 feet.

Every manufacturer of heavy duty precision surface grinding equipment has:

- √ **Testimonials from satisfied users.**
- √ **Records of fine finishes produced.**
- √ **Case histories of phenominal savings over other finishing methods.**

But there are other important factors that should be considered:

- √ **Maximum accessibility and control simplicity.**
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- √ **Longer accurate production life due to proven design methods, rigid construction and vibration-free operation.**

It has always paid the users of HILL Open Side Hydraulic Surface Grinders. It should pay you too!

Look for the added considerations before you buy!

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The Editor's Page

Designers! Look at Grinding

To those of us in the grinding industry there is no need to trumpet the advantages of removing metal with a wheel rather than with a hunk of steel or carbide, yet we are constantly amazed, as well as saddened, to see so many splendid shops hogging off metal with a planer, lathe or miller which should really be whisked off with a wheel.

What pricked this situation into our brain was an installation we saw in a shop which was surface grinding pads on a component. Simple as wiping up a spot on the table with a rag. No problems. No bottle necks. High production.

Imagine our interest when talking with a diamond wheel manufacturer recently who told how (some time ago) he had solved the problem of sharpening milling cutters for a pad facing operation. Turns out this company who had been milling the pads had been a competitor doing the identical job as the chappie who was now grinding them.*

There are too many people in industry who are not taking advantage of the economies permitted by grinding.

The designer, more often than not, is the villain in the piece. When he designs a shaft it is a great deal oversize . . . must allow for the scale which dulls cutters, you know . . . also give the tool a chance to get a solid bite . . . so let's increase the diameter some more. You all know what this means in terms of power consumption, tool and metal and labor cost, yet the entire shop bursts with pride as the cutting tool digs in deep amidst clouds of smoke and throws chips wildly all over the county like a fountain streaming water. When we have done with this piece of nonsense we put the shaft on a grinder and finish to size!

Take the sad tale of the flat surface. Perfectly flat surfaces are splendid for tables and desks and bookshelves, but as part of a manufactured product, No, No, a thousand times No! In the majority of instances flat machined surfaces are unnecessary; they can be designed with a series of bosses to receive holes for fasteners or they can be designed with a series of ribbed surfaces for mating with other surfaces; in other words, we don't have 200 square inches of solid metal to remove but only 20 square inches of ribbed surfaces, bosses and pads.

To be sure, this takes a little more designing, but the eventual saving of time and cost in grinding the flats is fantastic compared to the cost of surface milling 200 square inches of solid metal. This is just too much work, is much too hard, and is silly.

The entire subject may have been oversimplified a bit here, but basically, and honestly, don't we do too much single point turning and planing and milling when we really should redesign a mite and use grinding as a primary metal removal operation, at the same time finishing to size, frequently all in one operation?

*Before you cry, "Ho, ho, a likely tale," let us say we are prepared to furnish names and addresses to any Doubting Thomas.

Wm. J. Schleicher

Editor

Feeling M-i-g-h-t-y Low?

IF GRINDING WHEEL PROBLEMS HAVE YOU DOWN IN THE DUMPS, DON'T MONKEY AROUND. Switch to CINCINNATI (PD)° WHEELS. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION—a remarkable achievement in precision manufacturing and quality control that *can save you money . . . and increase your production.*

You'll start every day with a big smile and a spring in your step when CINCINNATI (PD) WHEELS are on the job. For through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.*

So, let us help you see the bright side of life once more. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio. Remember—*only* CINCINNATI Grinding Wheels give you . . .

(PD) POSITIVE DUPLICATION

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A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

°Trade Mark Reg. U. S. Pat. Off.

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Precision Grinding and Lapping at Sundstrand Aviation

Components for Sundstrand Aviation constant-speed AC generator-drive units, such as the one below for the B-47 jet bomber, must be made to extremely close tolerances and have fine finishes. This article describes typical operations at Sundstrand.

By **Jack Kenyon,** Associate Editor

● Precision grinding and finishing operations on many parts produced at Sundstrand Aviation, a division of Sundstrand Machine Tool Company of Rockford, Illinois, are particularly interesting because they offer many examples of close-tolerance work and extremely fine finish requirements.

Sundstrand Aviation builds several models of constant-speed drive units for AC generators used in many Air Force and Navy aircraft. The compact drive units, about the size of an automobile transmission, are actually hydraulic differential transmissions which convert variable input speeds of from 2000 to 9000 rpm to a constant output speed of 6000 rpm. Various model drive units transmit 32 to 95 horsepower from an airplane's main propulsive engine to the 400-cycle AC generators, with an overload capacity of 100% for five-second intermittent loads.

Power is transmitted in the drive hydraulically by means of an axial-piston, wobbler-plate type pump and motor combination or a radial-piston, eccentric-ring type combination.

As you would expect, parts for such a unit, operating at those speeds for extended periods in supersonic aircraft and capable of going from 1000 to 1700 hours between overhauls, have to be extremely precise, with fine surface finishes. Grinding and lapping are important in finishing most parts of the drives; we will discuss some of the interesting operations seen in a recent visit to the Sundstrand plant in Rockford.

Standards of precision in Sundstrand drives are high. In many cases, selective assembly of dimensionally paired parts is done to give the required fits and clearances in integral ball and roller bearings and other critical parts. But the consistent precision attained in normal production is most impressive. Noted in our visit was one batch of 24 wobbler plates, mating parts for the wobbler drive shafts which we'll discuss, which were remarkably uniform. Variation in the critical roller-race ID of the 24 plates was only .0001 in. over the entire lot. Such precision simplifies the job of "custom-grinding" mating parts and assures uniform performance of the assemblies.

Thoroughness of quality control methods are impressive. 100% inspection is required on all critical dimensions of most running parts, and inspectors enter their readings on an individual card which follows its part throughout processing. In many cases an inspector will work right along with an operator. As a batch of identical parts are ground, the inspector may make a sampling check on surface finish being obtained, to tell the operator how he's doing.

Magnafluxing is an important phase of quality control, to assure the absence of grinding cracks and other defects in the parts as they are processed. Many of the 52100 bearing steel parts are magnafluxed after every grinding operation.

Only a few representative operations can be discussed in our coverage, because some drive parts have 20 to 30 grinding operations performed on them, and the production grinding department contains some 150 grinding and lapping machines. More

machines are on order, and Sundstrand's systematic program of machine replacement is paying off in terms of reduced costs and increased quality.

We are indebted to Mr. Carl L. Sadler, general manager of Sundstrand Aviation; Mr. William Currier, manufacturing engineer; and Mr. Harry G. Carlson, grinding department troubleshooter, for their co-operation in the preparation of this material.

Sundstrand relies heavily on the skill of experienced operators like Russell Marinelli in critical grinding operations. This is finish grinding of roller race on motor wobbler drive shaft, done on a No. 2 B & S universal, first of three operations on the shaft discussed in our article.

Bearing Race Operations on the Motor Wobbler Drive Shaft

Finish grinding of a roller race and the rough and finish grinding of an important ball race are interesting operations performed on the motor wobbler drive shaft for the Boeing B-47E jet bomber's drive unit. Typical of shafts in Sundstrand drives, this one has two roller races and two ball races, inner and outer.

The race-grinding operations we'll discuss here, performed on a Brown & Sharpe No. 2 universal grinder, are done so as to match the shaft to the motor wobbler plate of the fixed-displacement hydraulic motor. The grinding operator has a previously finish-ground set of wobbler plates to be mated to the wobbler drive shafts. After the roller race is ground to match the plate, the two are a matched pair throughout subsequent operations and assembly. The races are inclined at an angle of 16 degrees 38 minutes with the major shaft axis in order to transmit the driving impulses from the axial pistons to the motor shaft. This necessitates use of a special inclined fixture during grinding.

For the roller race operation, the wheelhead is

set at a 20 degree angle with the work. The shaft, an AISI 52100 steel forging with a hardness of Rockwell 58-62C, is then placed in the fixture, locating on the shaft rear face and a small locating ID, both of which have been accurately ground for the purpose. Runout of the shaft in the fixture must be under .0002 in. before grinding is commenced.

Between .012 and .018 in. stock is removed in the roller race finish grinding operation. It is done so that the wobbler drive shaft race OD gives a clearance range of .0002 in. to .0006 in. with the motor wobbler plate outer race, as measured over .2361 in. rollers. A 16 microinch finish is specified.

For this operation the 14-inch A120-M6-V30 wheel is run at 1500 rpm and the work at 250 rpm, giving a surface speed of 6000 sfm. Following the grinding operation itself, the operator polishes the race OD with AA600 V7 lapping compound.

Inspection follows the roller race operation. The inspector enters the race diameter on the individual tag accompanying the shaft and marks the mating wobble plate with the serial number of the shaft so that the subsequent ball race grinding operations will again match the two components. The shaft is then inspected for flaws by means of magnaflux.

The ball race rough and finish grinding operations are performed on the same machine and with the same fixturing as the roller race operation on the wobbler shaft. Working from the shaft's turned surface, rough grinding removes about .018 in. stock, leaving between .004 in. and .007 in. for finish grinding.

Before grinding, the part is fixtured and checked for runout, this time on the previously ground roller race, to within .0002 in. TIR. Wheel for rough grinding of the ball race is a AA60-K6-V10. Infeed for this operation is .067 in. per minute.

Dressing of the proper ball race radius in the grinding wheel is done with a special yoke-type fixture on the grinder table which uses a single point diamond dresser. The operator dresses once in about ten parts.

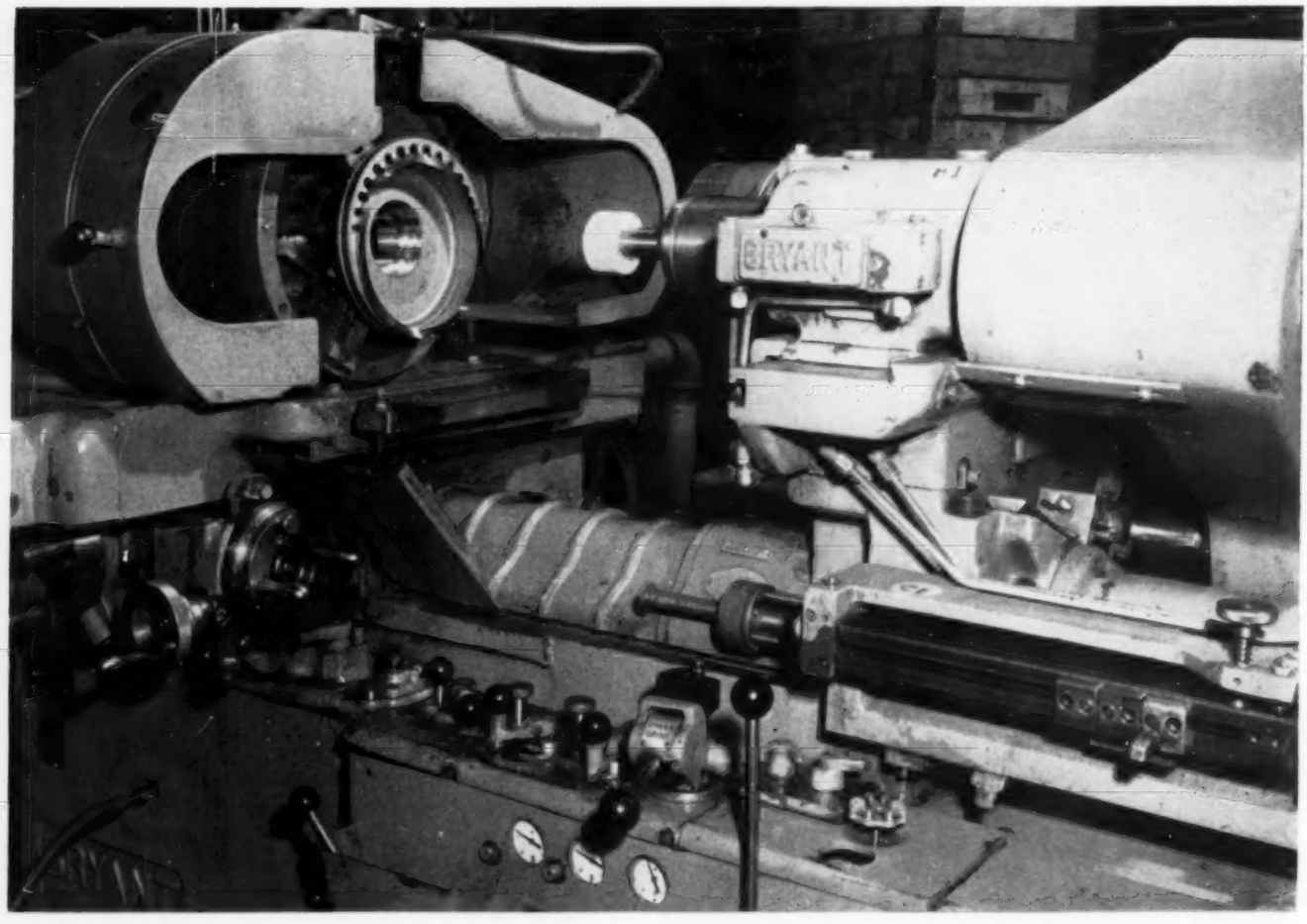
Following gaging of the rough-ground race diameter on a Federal dial gage, the part is again magnafluxed.

Finish grinding of the ball race follows magnafluxing, using an A80-M6-V10 wheel dressed in the same way as the wheel for roughing, with the yoke type dressing fixture on the table. For finishing, the diamond dresser shank is reset to give a slightly larger raceway radius than was generated in rough grinding. Tolerances for the ball race radius are plus or minus .0005 in., and a 16 microinch finish is specified.

Since the ball race carries a combination of axial and radial loading in the operating drive unit, the contact angle for the balls is specified as 45°, plus or minus 3°. Grinding of the inner ball race on the shaft must produce this angle, and an interesting method for checking the contact angle is employed by Sundstrand. To check the contact angle, the wobbler plate—the shaft's mating part, on which the inner race has been ground—is placed in the fixture. The bearing is then assembled using .5000

Pointer on ball retainer ring in checking setup at left tells whether ball race on drive shaft has been ground for proper contact angle, while height gage, center, checks axial location of inclined ball race. Arrow A indicates roller race, arrow B ball race discussed. White inspection tag accompanies part throughout processing, tells readings on all important dimensional checks.

in. diameter balls and a special ball retainer which has an indicating pointer fixed to it. A four pound brass weight is then placed on the top of the shaft to force the balls to the contact angle. The shaft is now rotated exactly ten revolutions causing the retainer to make four revolutions, and the pointer on the ball retainer will point to a certain place on the periphery of the fixture, which is scribed in degrees. If the pointer indicates a contact angle within the tolerance limits, the shaft is accepted.



Combination internal and facing operations on the radial-drive motor wobbler are done on this Bryant 1316R. Eccentric-shape part is driven by radially-placed pistons in drive unit.

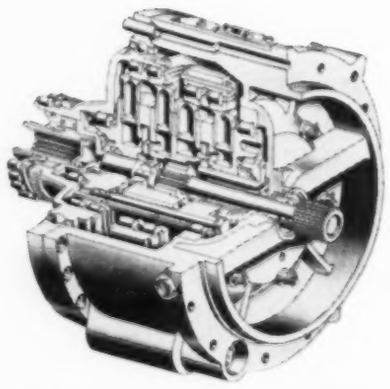
SUNDSTRAND

Internal and Facing Operations on Motor Wobbler

A good example of combination operations in a single setup is the grinding of three faces and three internal diameters on a two-spindle 1316R Bryant internal grinder, done on a part called the motor wobbler. This part is used in the Allison radial drive unit for the Air Force RB-66 photo-reconnaissance jet plane. In the radial drive, the radially oriented pistons are given their reciprocating motion by means of eccentric parts such as the motor wobbler.

The wobbler, an AISI 52100 forging which has been finish turned, is positioned in the Bryant 3-jaw chuck and located in depth with three stud faces. The part is checked with an indicator on the large face, within .003 TIR, before grinding.

First surface to be ground is the large face, ground



Cutaway of radial drive unit indicates location of wobbler on left end of assembly, driven by radial pistons.

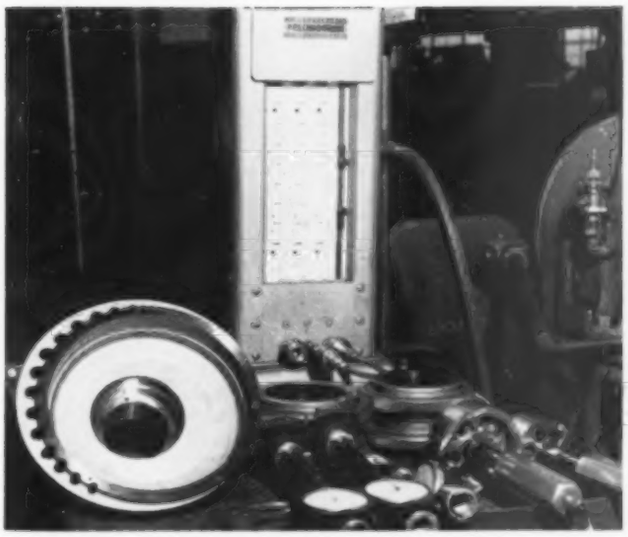
within .001 in. and to a 32 microinch finish. Wheel for this operation is a 6 x 2 x 2½ type 5 wheel, A60-H6B, run at 3500 rpm and hand fed. Stock removal runs around .010 in. to .012 in. for the operation. This face is lapped in subsequent operations for use as a locating surface in finish grinding various race diameters.

The remaining operations are done with the internal spindle, which mounts a 2 x 1½ x ⅝ wheel, 32A60-18-VBE, turning at 7500 rpm. A feed rate for the internal operations of .015 in. per minute is used.

The first internal diameter to be ground is the smallest, deep inside the part. It is ground to a diameter of 2.5350, plus .0005, minus .0000, and a 16 microinch finish is required.

The next larger ID is then ground, an oil ring seal not so critical for size, to 3.183 in., plus .005, minus .003, and the shoulder at the bottom of this bore is also faced in the same operation to tolerances of .001 in.

The third ID to be ground is again critical for size and finish. It is a roller race which must be held to plus .0003 in., minus .0000, with a finish of 16 micro. Again a shoulder is bumped at the bottom of the bore, with a tolerance of minus .001 in.



Sheffield air gaging is used to check all critical dimensions of wobbler. Ring and plug gages check others.

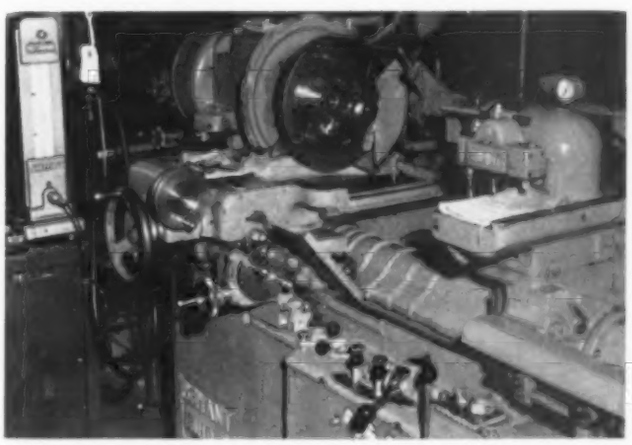
Internal Grinding of Pump Cylinder Block

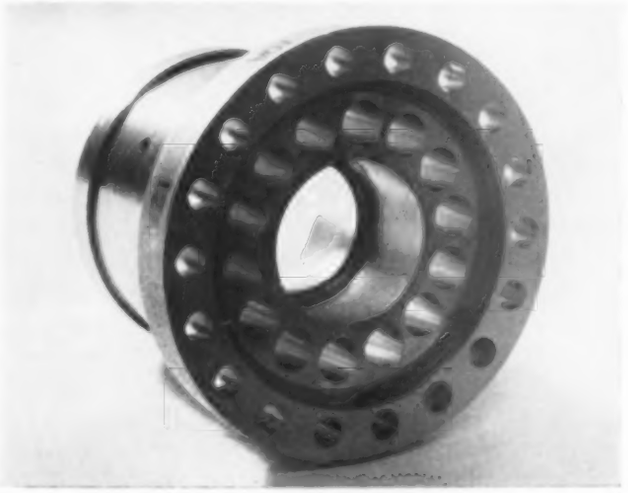
Grinding of the piston holes in the pump cylinder block of the axial-type Sundstrand drive for the Boeing B-47 jet bomber is done on Heald 271 and Bryant 1116R internal grinders with high-frequency wheelheads. Since the 14 pistons of this unit operate at extremely high speeds and must carry high hydraulic pressures, requirements for size, roundness, straightness and finish are unusually tight.

The 14 piston holes in the 52100 steel forged block are finished bored in a borematic type machine prior to this finish-grinding operation, leaving about .012 in. stock to be removed in grinding. Radial spacing of the holes is not held too critical; chordal distance between any two piston holes has a tolerance of plus or minus .003 in., and a plus or minus .002 in. tolerance is placed on the diametral distance of the piston circle from the block centerline.

The operator places the part in an indexing type fixture which permits grinding all of the piston holes without removing the part from the fixture. He merely loosens the fixture and indexes it between holes.

The 60,000 rpm wheelhead for this operation mounts a ½ x ⅝ x ⅛ wheel, GA-120-H5-V10, which is dressed once for every hole ground. Work spindle speed is 240 rpm. Cross slide feed for the operation is .003 in. per minute. Piston holes are finished to





Above, internal grinding of 14 axial piston holes for the Boeing drive on an 1116 Bryant with high-frequency wheelhead. Below, piston holes of Boeing drive (inner circle of holes) are ground to one of four .0001 in.-range groups, must be within 50 millionths of roundness and straightness, with 10 micro finish.

any of four specified size groups, each having a .0001 in. size range, and pistons are selectively assembled in the block according to the size group, which is marked on the block next to each hole.

Specifications call for holes to be round and straight within .000080 in., and a 10 microinch finish must be maintained. Gaging is done with a Sheffield air gage. A special gaging fixture checks the location and piston circle. Socony lapping oil No. 3 is the coolant for the operation.

Cylindrical Lapping of Pump Piston

Lapping is an important production finishing method at Sundstrand Aviation for many flat and cylindrical parts. Typical of the latter is the lapping of pump pistons for the Boeing B-47 drive unit, done on a Norton 100 lapping machine.

The pistons are of AISI 52100 bar stock steel, hardened to 81 - 83.5 Rockwell A. They are lapped to two size groups for selective assembly into the pump cylinder block; each size group has a range of .0002 in. Special workholder discs permit lapping of 40 pistons at a time in a four-to-eight minute lapping cycle, using U.S. Products 38-1200 compound in a mixture ratio of 8 ounces of compound to 2 quarts of No. 3A lapping oil. Work plate speed is 60 rpm.

Taper and out-of-round, specified not greater than .000080 in., are checked on a Cleveland Instrument Par-Ac electronic production comparator, and the surface finish of 8 micro maximum is determined by profilometer check. Comparator inspection is 100%.

Lapping of Boeing pump pistons on a Norton 100 machine. Sundstrand holds taper and out of round under 80 millionths, finish to 8 micro.

Flat Lapping of Transmission Housing

Many of Sundstrand's flat lapping jobs on large and medium-sized workpieces are handled on Crane Packing Company 48-inch Lapmasters. Typical of these jobs, where flatness and finish requirements are close, is lapping of the large (about 15-in. x 9-in.) face of a magnesium alloy transmission housing casting for the McDonnell drive unit.

The housing casting, on which the face has been previously milled, is loaded in the 17-in. diameter workholder which has a micarta spacer to prevent marring of the outer surface of the casting during lapping. Four housings are run at a time. A six-pound weight placed on each casting compensates for the irregular weight distribution of the part and insures uniform stock removal.

400 grit compound mixed in a ratio of 6 ounces of compound per gallon of Socony 3A lapping oil, with 2 ounces of lard oil, is standard as a compound mixture for this type of operation at Sundstrand. Lapping cycle is three minutes for this job, and it gives a surface flat within .0002-in., with a 16 micro finish.

Four transmission housings at a time are lapped for flatness and finish on 48-inch Lapmaster.

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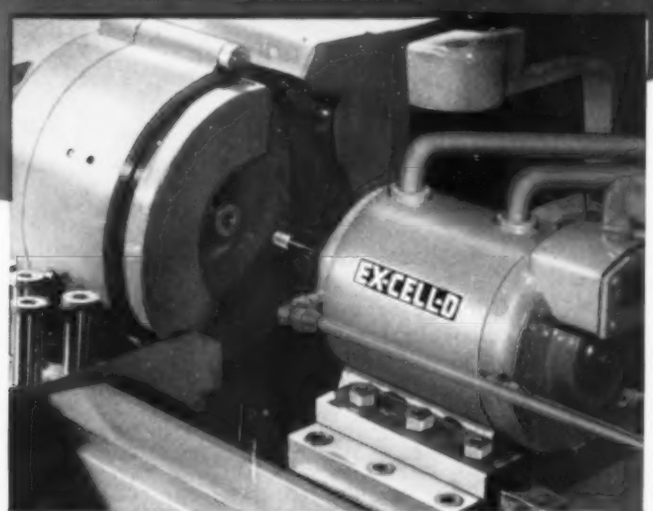

EX-CELL-O High-frequency Spindle, rated at 40,000 rpm, grinds small holes in bushings.

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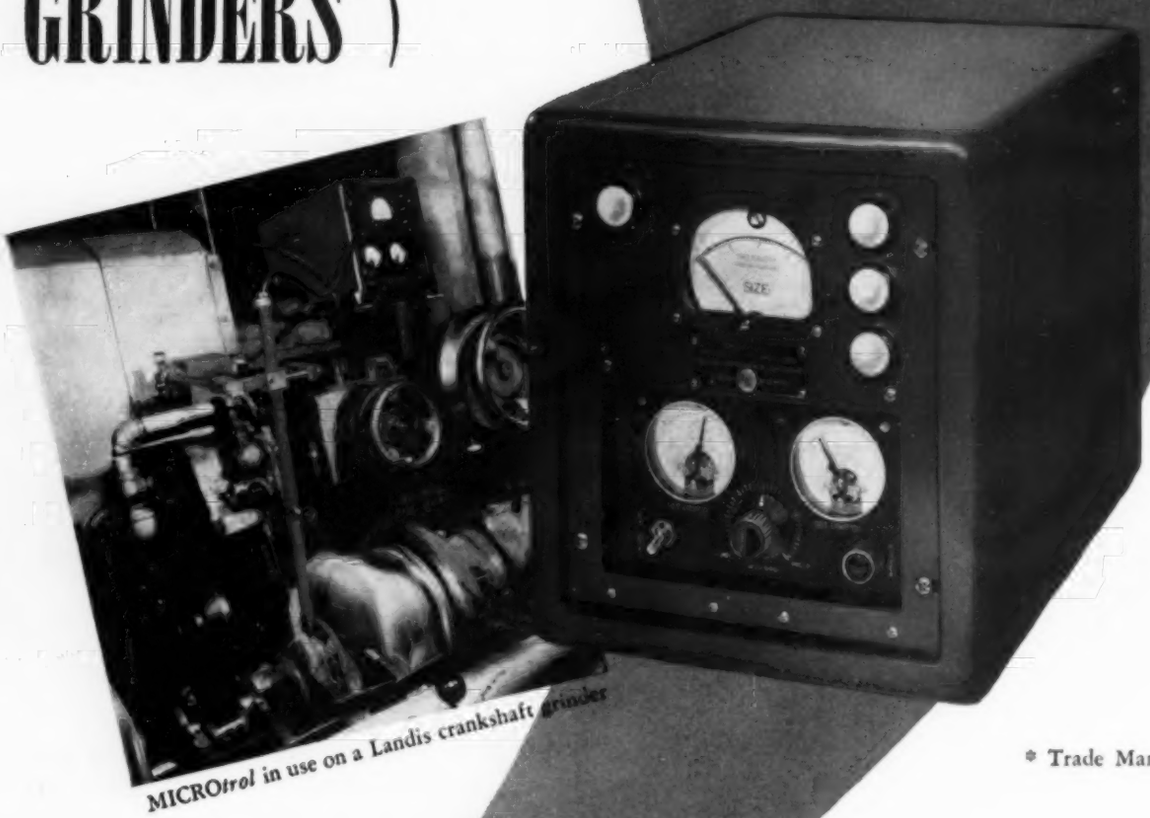
Automatic Size Control *for...*

PLUNGE GRINDERS *with* MICROTROL*

TYPE 150



MICRO*trol* in use on a Landis crankshaft grinder

* Trade Mark

The MICRO*trol* Type 150 provides extremely accurate automatic size control on any plunge grinder that is equipped for relay or solenoid control of wheel feed and withdrawal. By controlling such variables as the change from fast infeed to slow, amount of stock removal during sparkout, and wheel withdrawal at final size, MICRO*trol* eliminates both human and machine variables. Advantages are closer tolerances on finished work, elimination of scrap, faster and more consistent grinds, and improved surface finish.

These advantages are made possible by features exclusive with MICRO*trol*, including three-point control, super-accurate caliper and suspension, and drift-free caliper pickup and grinder control circuits.

The MICRO*trol* caliper pickup gages workpiece diameter continuously during grinding, and the MICRO*trol* control unit uses the gaging information for automatic control of final size. In addition, part size during grinding is continuously presented on direct-reading indicators, and lights signal arrival at the various size limits, including final size.

MICRO*trol* can be supplied as retrofit equipment for existing grinders, or can be specified as original equipment on new machines. Your inquiry will receive our prompt attention.

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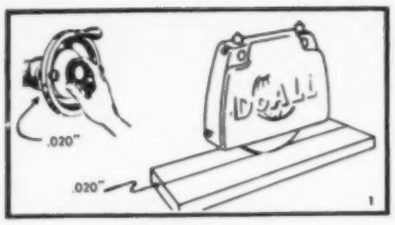
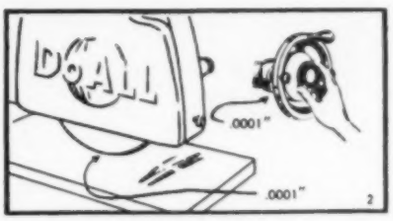
DoALL ELIMINATES "CUT AND TRY" GRINDING

Can Your Grinder Meet The Test?



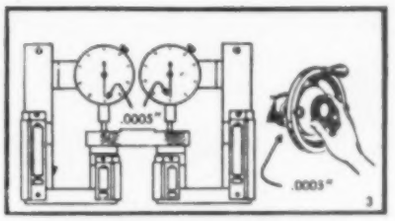
NO SPARK-OUT

1. Take a .020" cut with .020" crossfeed in 59-60 RC tool steel. A DoALL Grinder will run back through the cut with absolutely no spark-out!



ERASE PENCIL MARK

2. Now, put a pencil mark across the cut. Feed down .0001" and run the wheel through the cut again. A DoALL Grinder will erase the pencil mark!



DUPLICATE DIMENSION

3. Downfeed .0005" and grind $\frac{1}{3}$ the width of the workpiece. Do the same to the opposite $\frac{1}{3}$ of the surface. Both cuts will check out at .0005" when done on a DoALL!

WHAT FEED SETTING SAYS— DoALL GRINDER DOES!

If the downfeed calibrations of your grinder do not represent an equivalent amount of stock removal, then you are paying a premium for the work it performs. It is a costly waste of time to grind, and measure, then grind and measure repeatedly, to reach a desired dimension. Try the above test on your grinder. Then ask to see the same test on a DoALL Grinder. You'll see why grinding time on a DoALL is productive time!

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Pages from

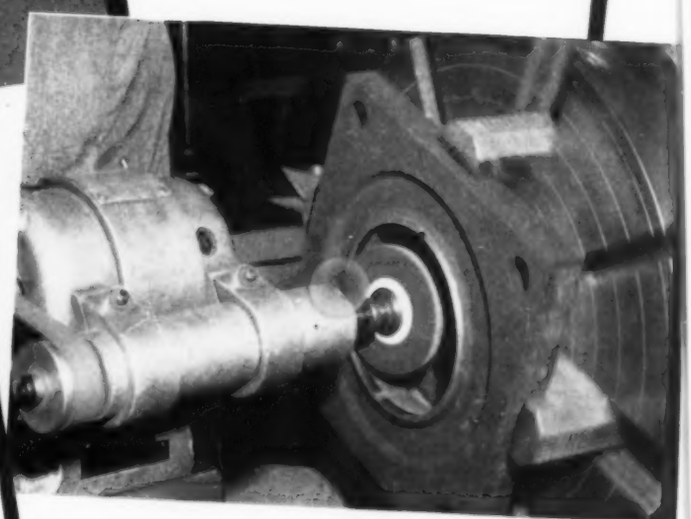
The INSIDE STORY of INTERNAL GRINDING by NORTON

How Norton wheels for internal grinding step up your product quality and profits with the

"TOUCH of GOLD"

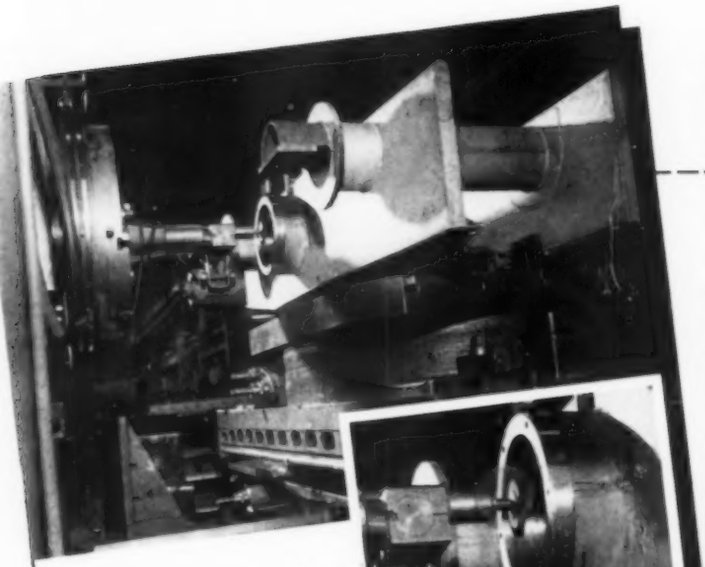
They're Precision-Processed

Norton wheels for internal grinding are built by exclusive precision-processing that results in absolutely uniform grinding action, in wheel after wheel of the same specifications. This means you can depend on each Norton wheel of the same specifications for exactly the same grinding action. No fussing with timing cycles when you change wheels — you save on every grinding job. Other typical "Touch of Gold" advantages include their fast, free, cool-cutting action and extra long life. Norton wheels are made in types, sizes, bonds and abrasives for every internal grinding application.



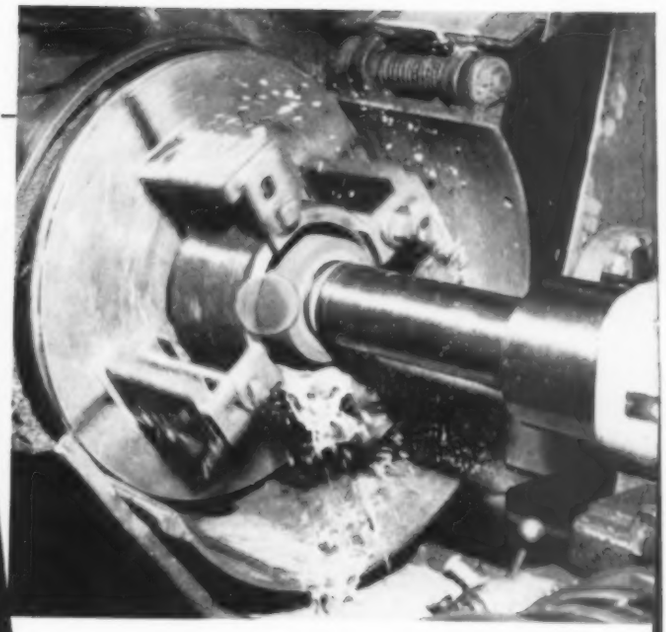
The Famous Norton G Bond

The Norton G Bond is the most efficient vitrified bond ever developed for precision and semi-precision grinding. Holding each abrasive grain just long enough for maximum cutting action, it assures a constant grinding surface of fresh, sharp cutting edges. As a result, G Bond wheels cut cooler and faster . . . produce smoother finishes . . . dress easier and give more pieces per dressing. With Norton 32 ALUNDUM* abrasive — outstanding for heavy feeds and rapid stock removal — it makes an ideal "Touch of Gold" combination for your grinding jobs on steel and steel alloys.



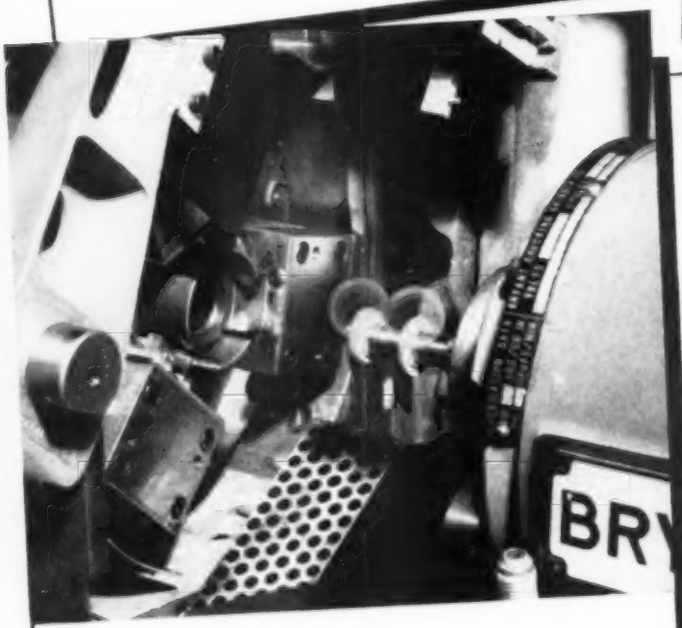
An Unusual Set-Up

Grinding bearing housings with a Norton wheel on a Dumore tool post grinder, mounted on a horizontal boring mill. The grinder itself revolves in a planetary motion, the grinding wheel spindle following the I.D. of the hole. To grind the other end of the housing the work table is turned 180°. *Material:* cast steel. *I.D.:* 7.8737". *Stock removal:* .005" each end. *Limits:* +.0001", −.0004". *Time:* two hours each end



Rounding It Out—Fast

During hardening, a certain amount of warpage occurs in this steel mould band. A Norton wheel is grinding it perfectly round and smooth. The band has an I.D. of 6" and is 4" deep. Average amount of stock removal is .040" and the time cycle is 30 minutes.



Precision Performance—Doubled

Here a Norton two-wheel set-up is ready to go into fast grinding action. The job is grinding a double race in a steering gear bearing. *Material:* SAE 1045 steel, 54 Rockwell C. *I.D.:* 1.1507". *Stock removal:* .012". *Limits:* +.0000", −.0005". *Finish:* 10 microinches RMS.

See Your Norton Distributor

for further facts on how Norton wheels can bring the value-adding, money-saving "Touch of Gold" to your own internal grinding operations. He'll be glad to arrange a test in your plant. Or write direct to your nearest Norton district office. And remember: only Norton offers you such long experience in both grinding wheels and grinding machines. NORTON COMPANY, Worcester 6, Mass. Offices in nine cities. Distributors in all industrial areas — listed under "Grinding Wheels" in your phone directory, yellow pages. Behr-Manning, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated.

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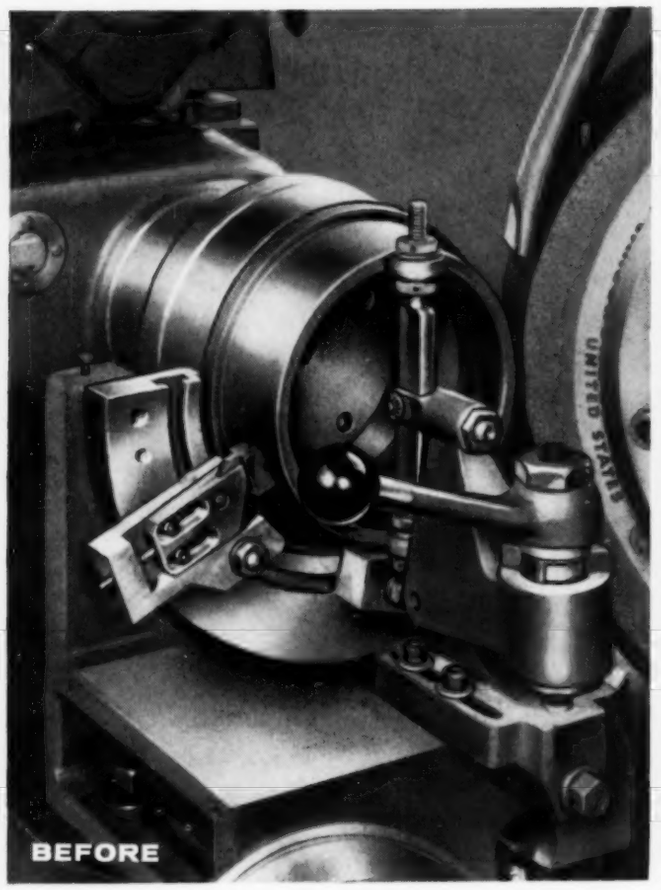
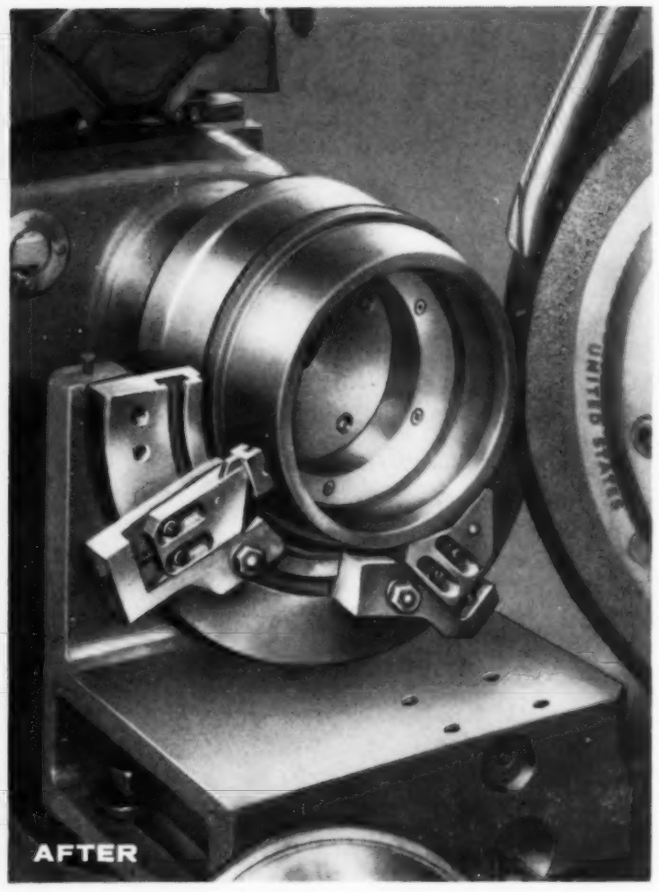




New Taft-Peirce Magnetic Work Driver Cuts Shoe Type Centerless Grinding Costs

If you're considering or now doing shoe type centerless grinding, you should look into Taft-Peirce Magnetic Work Drivers. A variation of a rotary magnetic chuck, they hold work magnetically.

Simplifies setups. By eliminating complex tailstock arrangements.

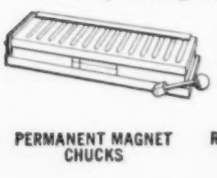
Speeds production. Permits faster automatic or manual loading and unloading.

More versatile. Can be used for greater range of work sizes.

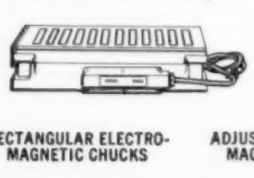
More dependable. There's little can go wrong with its simple, sturdy construction.

What's more, it costs substantially less than present complicated holding devices . . . requires little or no maintenance.

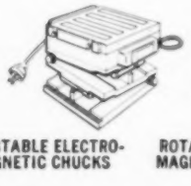
Furnished in either electromagnetic or permanent magnet models . . . designed to suit your requirements. Learn more about this time-and-money-saving work driver. Write today.



PERMANENT MAGNET CHUCKS



RECTANGULAR ELECTRO-MAGNETIC CHUCKS



ADJUSTABLE ELECTRO-MAGNETIC CHUCKS

ROTARY ELECTRO-MAGNETIC CHUCKS

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

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Part 2– Grinding and Finishing Stainless

How to Get Top Performance in

Polishing and Buffing of Stainless Steel

FIG. 1 Polishing a large formed shell—Original finish on sheet was 2D. (Armco Steel Corp.)

- ✓ **Shop headed wheels as well as factory coated abrasives are discussed**
- ✓ **You must know and respect the characteristics of the stainless steels**
- ✓ **Finishing operations should be planned so that metal removal to finish desired is a gradual process**

By **Lester F. Spencer,** Consultant
Washington, D.C.

● In standard finishing operations, which would include grinding, polishing and buffing, the grinding operation usually refers to a heavy cutting operation as exemplified in many precision grinding operations. This type of finishing is frequently referred to as "hard wheel grinding" and can be used for the removal of weld beads and protrusions on castings.

Polishing can also be classified as a cutting operation. However, it is considered as the initial step in preparing a surface for final buffing. The amount of metal removal is usually less than that experienced in grinding; the number of polishing operations varying in accordance to the original surface condition of the part. Buffing follows the polishing operation, producing a highly reflective surface. This operation is frequently divided into a cutting down and a color buff; each type using soft fabric wheels, a very fine abrasive and relatively high speeds.

In considering polishing operations, shop headed wheels as well as factory coated abrasives will be discussed. The shop headed wheel is the type that is developed by the fabricator, whereas the factory coated abrasive is purchased in the form of coated strips or belts. In considering the shop headed wheel, the factors of importance would be the wheel material; the abrasive; and the bonding agent.

As to the wheel material, the following types of materials are recommended, thus:—

1. **CANVAS WHEEL.** Wheels made of canvas discs cemented together or sewed are excellent for heavy work with a coarse abrasive ranging from 24 to 46 grit. It can be used where slight surface imperfections are removed.
2. **STITCHED MUSLIN WHEELS.** These are used from coarse grinding to fine polishing. They are usually purchased already assembled to the size and width desired. However, some shops make their own wheels by gluing or cementing standard buff sections together to obtain the required width.
3. **SOLID FELT WHEELS.** These are generally employed with 150 or finer grit to obtain high finishes.
4. **COMPRESS WHEELS.** These are used when a formed wheel face is necessary. They are also suited for work done by the stitched muslin wheel. Wheel faces are usually made of rectangular blocks of leather, canvas, felt or walrus radically compressed and assembled into steel side plates. This block construction permits accurate control of hardness or density of the wheel face. In addition, the face will retain its shape when formed to fit the contour of the work because of the bias assembly of the segments.

Factory coated abrasives are increasing in usage.

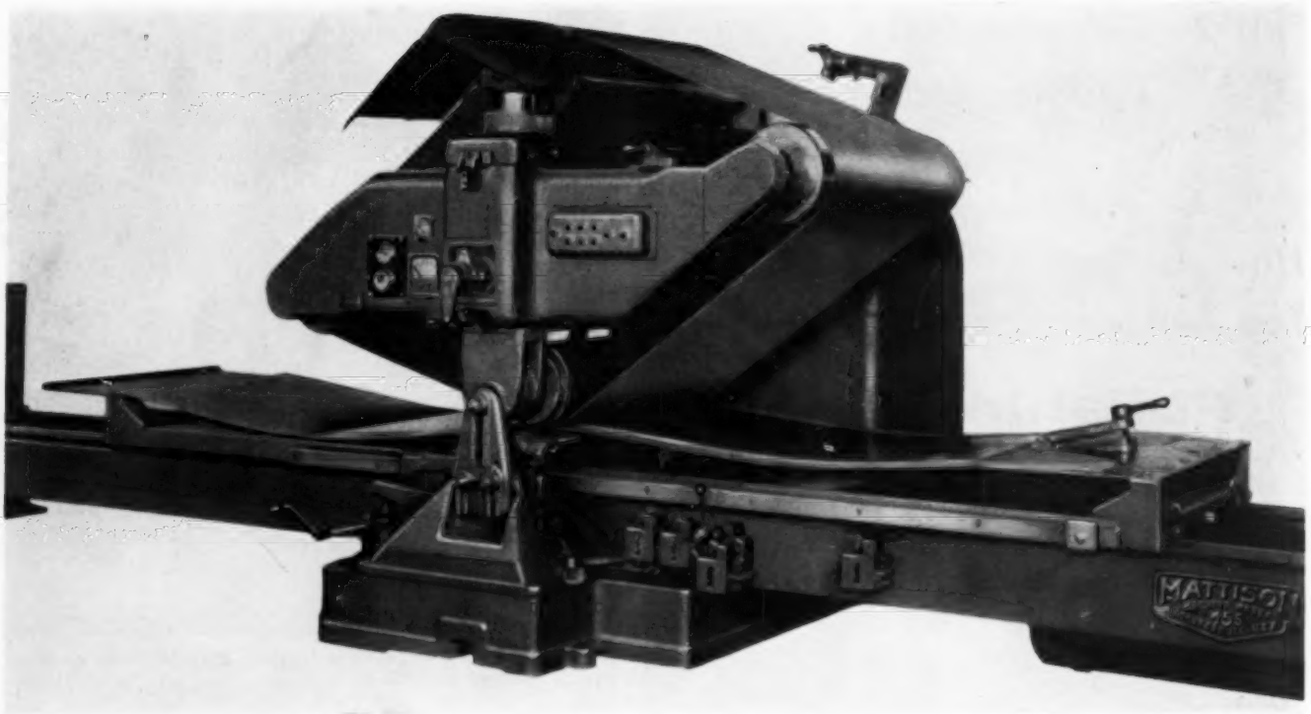

FIG. 2 Wide belt sheet grinding and polishing machine. (Mattison Machine Works).

The versatility of this material is reflected in that it is employed from roughing operations to fine polishing. This material is used as:—(a) paper or cloth strips which are placed over the face of special contact wheels; (b) as endless cloth or paper belts used with backstand idlers over cushion wheels on polishing lathes and swing grinders; (c) as endless abrasive belts used on hand block sanders. In this instance, the flexible wheel is replaced with a canvas faced curved hand block of cork; and, (d) to surface various types of wheels and discs used on flexible shaft machines.

Advantages of Factory Coated Abrasives

The advantages frequently associated with factory coated abrasives include:—

1. The elimination of shop heading which requires considerable equipment and experience;
2. The abrasive belts usually are of maximum uniformity and quality. In shop coating there is always a danger of mixing grits of different sizes. The introduction of even a few coarse grits may cause scratching of the surface and necessitates reworking of the part.
3. An abrasive belt provides considerably more abrasive surface than either a wheel or a roll. Thus a 10 inch abrasive wheel has a circumference of about 31½ inches. When this abrasive wheel is replaced with a resilient work wheel and backstand idler, endless abrasive belts of 84 to 168 inches long can ordinarily be employed. Consequently, the available abrasive surface has been made 3 to 5 times as long as when using an abrasive wheel. In addition, the belt also has a chance to cool in its travel around the work wheel and idler.

The wide sheet grinding and polishing machine illustrated in Fig. 2 is an excellent example in the use of factory coated abrasive belts. This type equipment is built in various sizes to finish sheets that are 36, 48, 60 and 70 inches in width. The length of the abrasive belt on all of the above sizes is 243 inches.

Aluminum oxide abrasive is ordinarily used for the grinding and polishing of the stainless steels; this material is preferred to silicon carbide due to its

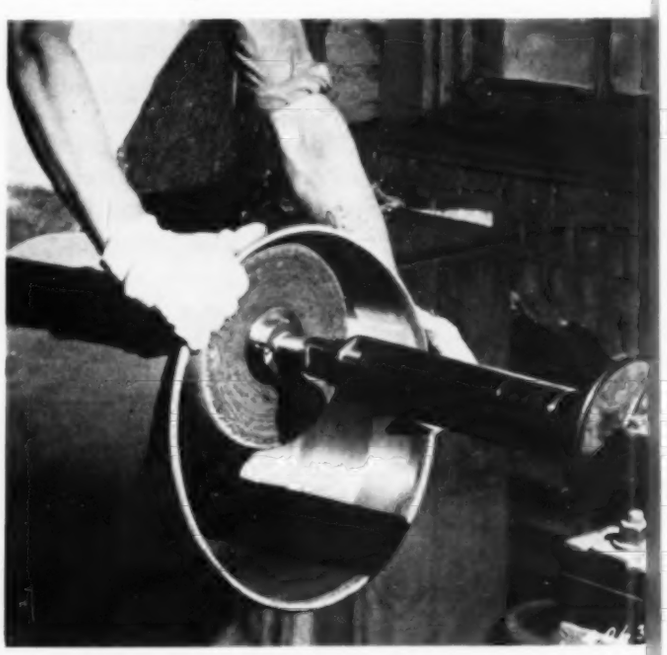

FIG. 3 Polishing inside of a drawn shell made from type 302 stainless.

Table I. Suggested Sequence of Operations in Finishing the Stainless Steels

Finish*	Sequence	Abrasive	Lubricant	Wheel		
				Type	Size**	Speed***
Welds		Abrasive Oxide Grit No. 40-60	Dry	Rubber or Bakelite Bonded	4-8	4000-6000
No. 1	1	Aluminum Oxide Grit No. 60-80	Tallow or Grease Stick	Shop Headed or Factory Coated Wheels or Belts	12-14S 5-6P	6000-8000
No. 2D or No. 2B	2	Aluminum Oxide Grit No. 80-100	Tallow or Grease Stick	Shop Headed or Factory Coated Wheels or Belts	12-14S 5-6P	6000-8000
No. 4	3	Aluminum Oxide Grit No. 150	Tallow or Grease Stick	Shop Headed or Factory Coated Wheels or Belts	12-14S 6P	6000-8000
No. 6	3B	Pumice, Lime or Silica Flour	Oil and/or Kerosene	Tampico Brush	8-16	2500-5000
No. 7	4	Aluminum Oxide Grit No. 180	Tallow or Grease Stick	Shop Headed or Factory Coated Wheels or Belts	12-14S 6P	6000-8000
	5	Aluminum Oxide Grit No. 240-280 Abrasive Stick		Buff	12-14S 6P	9000-10000
	5B	Stainless Buff Compound		Buff	12-14	7000-9000
No. 8	6	Aluminum Oxide Grit No. 320-400 Abrasive Stick		Buff	12-14S 6P	9000-10000
	6B	Stainless Buff Compounds		Buff	12-14S 6-8P	7000-9000
Scratch Free Mirror	7	Stainless Buff Compounds		Buff	12-14S 6-8P	7000-9000
	8	Stainless Buff Rouge		Buff	12-14S 6-8P	7000-9000

*Sequence of finishes which can be produced when starting with No. 1 pickled finish or No. 2D or 2B cold reduced finish.

**Wheel diameter in inches.

***Speed in surface feet per minute.

NOTE—Operations 3B, 5B and 6B are special steps to finish off at the respective No. 6, No. 7 and No. 8 finishes. When working through a higher finish, the "B" operations are not used. S—wheel diameter for stationary machinery. P—wheel diameter for portable machinery.

greater point endurance. The choice of grain size of the abrasive will depend both on prior surface condition of the part and the finish desired. Suggested sequence of operations for grinding, polishing and buffing are given in Table I.

Uniformity in composition, structure and size is the prime requisite of an abrasive. In shop heading practices, good bonding action between the wheel and the abrasive requires high capillarity to allow easy wetting with the glue solution through surface treatment of the grain. Where various grit sizes are employed, they should be kept separated. Abrasives should be clean and iron free in order to prevent subsequent contamination of the items polished and possibly impair their corrosion resistance. Natural emery is not recommended for the grinding and the polishing of the stainless steels; the artificial emery is more effective and also is iron-free. In the finer grits, No. 150 or better, Turkish emery is said to be preferred since it doesn't scratch as deep.

Composite cloth wheels give the needed resilient backing to the abrasive grit. The stiffer the wheel the faster it will cut and, although softer wheels have a reduced cutting rate, a finer finish is produced with the same grit. These cloth wheels are made by gluing or cementing sewed muslin buffs until the desired width face is obtained. The muslin buff sections are usually ¼ inches in thickness, consisting of cloth sewed either by a spiral, concentric or radial stitching. The degree of resilience can be controlled to some extent; the highest degree of resilience is obtained by gluing the laminated discs in the entire area from hub to near the periphery. This factor can also be controlled by more frequent and closer sewings within the buff section. Usually the finer and tighter the weave of cloth, the stiffer the buff and the longer is its life. For stainless steels, buff sections with cloth thread count of 64/64 or

FIG. 4 Rolling wheel in abrasive trough after applying glue. (Armco Steel Corp.)

64/68 are recommended for optimum results.

A high quality animal hide glue is recommended as the bonding agent. Bone glue, fish glue and cold glue preparations are relatively inefficient. Commercial silicate cements and other similar binders are being used with success without heating. Suggested mixtures are given in Table II; these values are used for wheel speeds of approximately 7500 s.f.p.m. Where speeds as high as 9000 s.f.p.m. are employed, the glue content within the mix should be increased by about 5 percent by weight to give a denser head.

Cold tap water is used to dissolve the glue; the time is usually one hour for ground glue and about 12 hours for flake glue. The quantity should be limited to about a three hour supply; porcelain enameled iron or stainless glue pots and water-jacketed heaters are recommended.

All equipment used should be kept clean so as to prevent bacterial growth and subsequent contamination of succeeding batches of glue. It is also recommended that a different brush be used for each grain size so as to prevent the possibility of mixing grits.

Table II

Size of Aluminum Oxide Grain (Grit Number)	Percent Glue by Weight	Percentage Water by Weight
24 to 36	50	50
46 to 54	45	55
60 to 70	40	60
80 to 90	35	65
100 to 120	33	67
150 to 180	30	70
220 to 240	25	75

The temperature factor when applying the glue will vary. Thus, where both the wheels and the grit are preheated, the glue is applied at a temperature of 140° F., and, where these components are at room temperature, the glue is heated to 160° F. This temperature factor should be controlled thermostatically and a thermometer should be kept in the glue pot as an added precaution.

In preparation of a wheel, it is recommended that either one or two coats of a 5 to 10% glue sizing be applied hot to the preheated wheel face.

After sizing, at least two coats of abrasive in glue will be required, drying carefully after each coat. The glue is applied to the face of the wheel and rolled in a trough of abrasive grit until it has picked up all the grain it can hold. The entire operation should be carried out as quickly as possible so as to minimize the jelling of the glue during set-up.

When pre-heated wheels and grits are employed, a recommended temperature is from 100 to 200° F. Light pressures is all that is required to obtain proper penetration of the grain in the glue coat. Thus, where the production of shop heads are relatively high, a uniformity of product is obtained by the use of power driven wheel heading machines which exert controlled and measured pressures during rolling of the wheel. In addition, this equipment keeps the abrasive grains heated.

In the event hide glue is employed, the drying operation should reduce moisture content from 10 to 12%; the drying time will depend upon the thickness of the wheel head which in turn is influenced by grain size, glue strength and the number of coatings. A 24 hour period in a controlled temperature drying room is satisfactory for a one-coat abrasive wheel head, while a 48 hour drying period is used for a two coat wheel head. The drying operation is critical to obtain maximum strength; an under-dried wheel will cut slowly, glaze and overheat, whereas a wheel that has been overdried will be brittle and have short life.

Shop built wheels must first be trued on the polishing lathe spindle with a commercial buff rake or a sharp cutting tool.

In this operation the nap is laid back on the face of the wheel. In order to keep this nap in the same direction as when trued, the wheel is marked on its side with an arrow so as to indicate the same direction of rotation in service. This will insure longest wheel life. The balancing of wheels will minimize chatter, vibration, rumble, selective shedding of grains and the number of re-dressings during the life of the wheel. Static balancing is usually performed; lead washers being employed on the light side to obtain this balancing. Balancing tubes within the pressed steel hub often provide anchorage for these lead washers; this is usually the case where leather or canvas faced wheels are employed.

Another standard practice is "cracking the wheel

head"; this usually is done by striking lightly with a round bar or pipe. The direction of the blow is diagonal at an angle of approximately 45 degrees; this being done at intervals along the entire circumference of the wheel. This is repeated from the other side of the wheel so as to produce an "X" mark. A sharp edged instrument is never used since there is a danger of chipping the wheel head. Heavy blows may distort the wheel.

A grease stick, which usually consists of a mixture of mutton tallow and stearic acid, is normally used as a lubricant in the finishing of fabricated items. In the finishing of flat sheets, a liquid lubricant, such as a mixture of kerosene and machine oil or palm oil, is usually employed.

The Buffing Operation

The buffing operation, which produces a high lustrous and reflective finish, usually consists of a "cutting down" and a "color" buff. As is indicated in Table I, 240 grit or higher abrasive size is identified with the buffing operation. Muslin buff sections built up to required width are used for buffing operations, very similar to that used for polishing with the exception that the wheel face need not be prepared.

The abrasive employed is incorporated in the grease stick or cake compound which is applied to the face of the wheel. The abrasive is a levigated alumina which must be iron-free. For high finishes, a rouge composed of green chromic oxide (CR_2O_3) should be used. In addition, buffing should not be attempted on a surface that is coarser than that obtained with either a 200 or a 220 grit used with proper lubricants.

FIG. 5 Safety deposit box doors made from 430F stainless being buffed after the normal surface grinding operation.

Commercial buffs may be standard as exemplified by the concentric, radial, radial arc, parallel and squared sewed to loose buffs with the layers of fabric sewed once around the arbor hole. The standard cloth section is usually 20 plies of cloth; the recommended cloth count for buffing stainless steel is at 86/93. As in polishing, the face width of the buffing wheel is produced by placing the buff sections together; the resilience of the wheel being regulated by placing cardboard spacers on the hub. Due to the high speeds experienced in buffing and

Table III. Special Polishing Procedures for the Stainless Steels

Desired Finish	Starting Finish	Operation Sequence	Abrasive	Wheel		
				Type	Size	Speed
No. 6 or Satin	No. 1	1	Aluminum Oxide Grit; No. 60 to 80*	Shop Headed or Factory Coated Wheels or Belts	12-14S 5-6P	6000 to 8000
		2	Aluminum Oxide Grit; No. 100 to 120*	Shop Headed or Factory Coated Wheels or Belts	12-14S 5-6P	6000 to 8000
		3	Satin Finishing Compound (Lea Cpd.* Grade B)	Sewed Buff	6 in.	5000 to 6000
		4	Learok, Grade 304-B	Loose Buff	6 in.	6000 to 8000
Removal of Heat Tints	Welding Heat Tints	1	Nu-Steel Paste or Liquid	Tampico Brush	8 in.	2400 to 3000
		2	Nu-Steel Powder	Hand Clean with Flannel Cloth		
Wire Brush	No. 2D or No. 2B	1		Stainless Steel Brush		4000 to 6000

*Use Grease Stick Lubricant

**Top dress with small amount of Learok Grade 304B on the Lea Compound coating for lubrication.

the toughness of the material, the bias or "special ventilated" type buff is the best to prevent scorching. Buffing wheels made from alternate plies of muslin and sisal, which is a hemp product, resist scorching and have proven satisfactory in buffing the stainless steels. In a "cutting down" operation, the efficiency of the operation is dependent upon the efficiency of collecting and holding the compound; this factor is dependent upon both the type of cloth and the amount of stiffness obtained by the sewing or puckering of the buff ply. Usually the harder the buff, the faster the cut.

The speeds at which either "cutting" or "coloring" buffs are to be operated will vary with the shape of the work. **"Cutting" buffs operate to a maximum of 10,000 s.f.p.m. while "color" buffs are at a maximum of 9,000 s.f.p.m.** Speeds in excess of these values are hazardous in hand buffing odd shaped work pieces and, in addition, buff wear may be excessive.

Special polishing procedures are given in Table III. A word as to wire brushing, which is practiced widely, is that the brush should be of the same material as the worked part. Stainless type 302 items that were wire brushed frequently exhibit a rusting condition; when this happens, be sure that the rusting is not characteristic of the stainless, but rather to the particles of embedded iron which may have come from the plain carbon steel brush employed for wire brushing. Not only is it essential to use a stainless wire brush, it also is an excellent idea to insert a passivation treatment which will immunize the stainless.

Summing Up

The finishing of the stainless steels need not be difficult if the characteristics of these materials are known and respected. Observe these:—

1. Do not increase wheel pressure to obtain shorter finishing time since this will lead to over-heating and, in severe cases, distortion and warpage.
2. When a fresh abrasive wheel or belt is placed in production, the use of a scrap piece of material to break in the wheel is recommended.
3. When changing from grit to grit, care should be taken to avoid mixing of grits. This is not only true in wheel preparation but also where wheels containing various grit sizes are used. In the latter case it is advisable to clean the work before proceeding to the next wheel having the finer grit.
4. In polishing, the abrasive scratches should be straight and parallel. Herringbone scratches, gouges and chatter are averted by proper technique.
5. Plain finishing operations carefully so that metal removal to finish desired is gradual. In the event of spot polishing, those areas which are not touched should be suitably protected by masking with adhesive paper.
6. Experimental work is of value. Work can be done on procedures, methods of improving wheels and wheel preparation, effect of grits and compounds.

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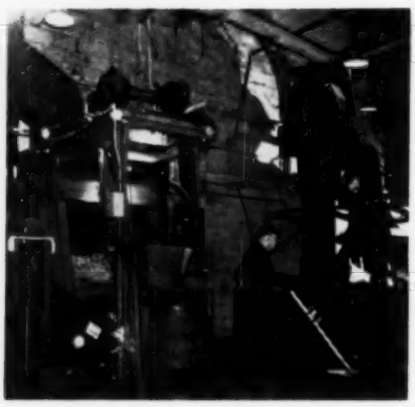

200,000 RINGS are blast cleaned per 8-hour shift in three machines operated by one man with the aid of timers, power doors and loading and unloading devices.

SPRUES AND RISERS are cleaned 2-3 minutes after piston ring castings have been removed, to remove sand prior to remelt. Cycle timing is automatic.

New Method for Cleaning Piston Ring Castings

Increases production, improves quality and saves floor space at Muskegon Piston Ring Co.

• By replacing six airblast cleaning barrels and ten tumbling mills with four Rotoblast Blastmaster Barrels made by the Pangborn Corporation, Hagerstown, Md., Muskegon Piston Ring Company, Sparta, Mich., has increased the rate of blast cleaning of piston ring castings two to three times, improved the quality of the pistons and saved considerable floor space.

An average of 200,000 rings are cast per 8-hour shift from 3 ft diameter down to ½ in. diameter. Two 12 ft GN Blastmaster barrels clean the rings after they have been cut from the sprues and risers. Close control of blasting time must be maintained because piston rings are thinner today than they were formerly (5/64" today—¼" previously). Overblasting causes warping and a too smooth finish. Yet perfect cleaning is essential to quality of product.

Each Barrel Has Timer

Each barrel is equipped with a timer that automatically shuts off the barrel at the end of the cleaning cycle of five to six minutes. The automatic shut-offs, power doors and powered loading and unloading devices permit one man to handle a group of three barrels.

Two 18 ft "GN" Blastmaster barrels clean the sprues and risers before remelting after the piston ring castings have been cut off. Cleaning cycle for this operation is two to three minutes.

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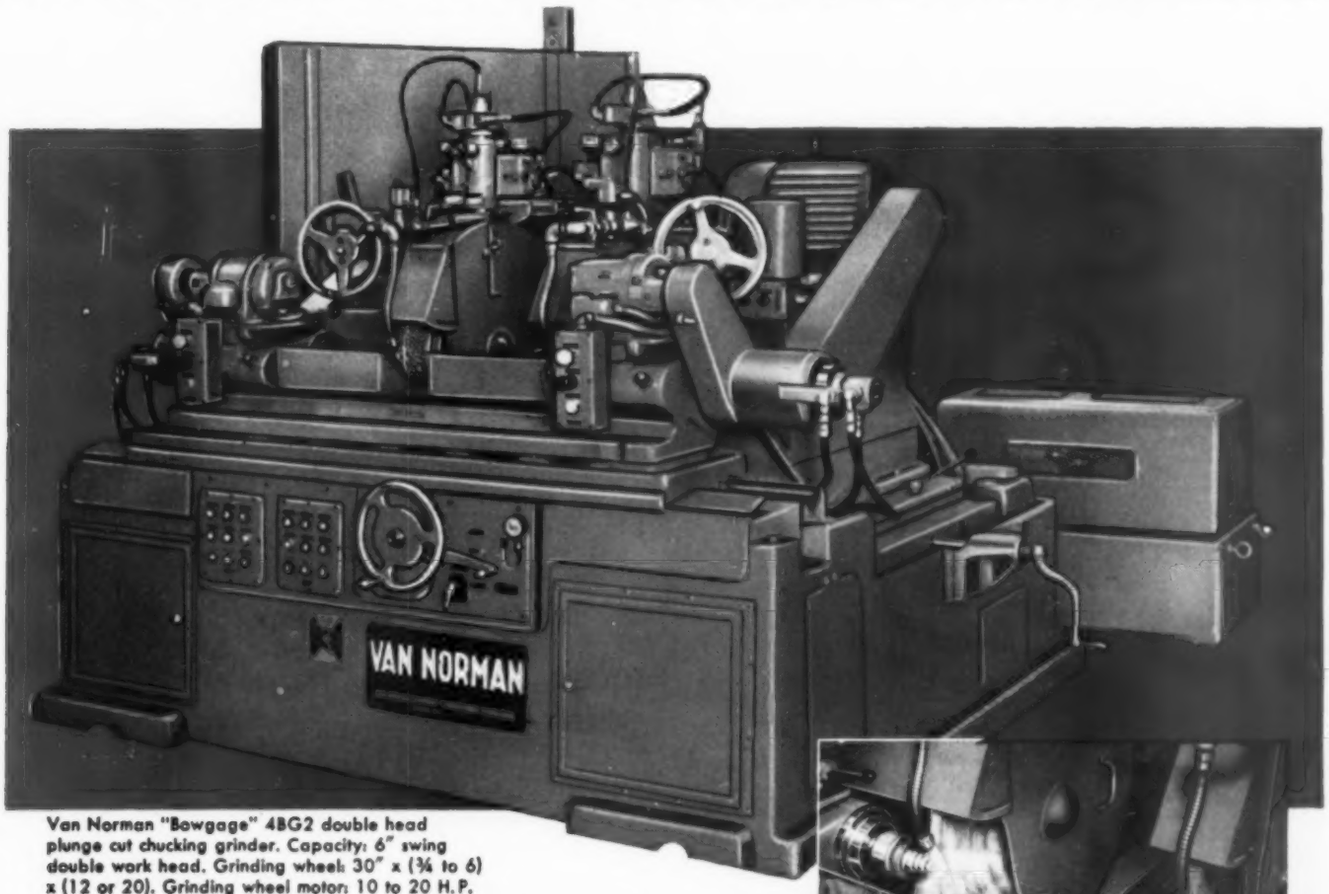

Van Norman "Bowgage" 4BG2 double head plunge cut chucking grinder. Capacity: 6" swing double work head. Grinding wheel: 30" x (¾ to 6) x (12 or 20). Grinding wheel motor: 10 to 20 H.P.

Grinding Universal joint flange on the Van Norman "Bowgage" 4BG2 .022 stock removal — 1.625 diam. — 15 R.M.S. — Maximum 480 pieces per hour.

You just can't beat Van Norman "Bowgage" Production Grinders for fast, economical mass production. These massive, rugged grinders are "*engineered for the job*" to meet your exacting requirements.

Illustrated is the Van Norman "Bowgage" 4BG2 double head plunge cut grinder designed and built for a major automotive manufacturer. Day after day, this 14.8 ton rugged brute and other single and double head grinders are showing substantial savings by keeping production up and costs down.

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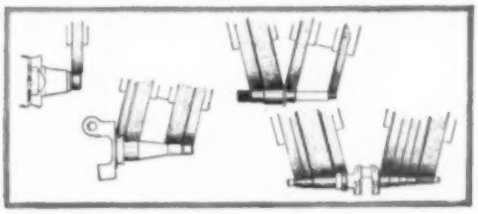
Sketches illustrate actual grinding applications performed for users of single and double head plunge cut special purpose grinding machines.



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TRUFIT

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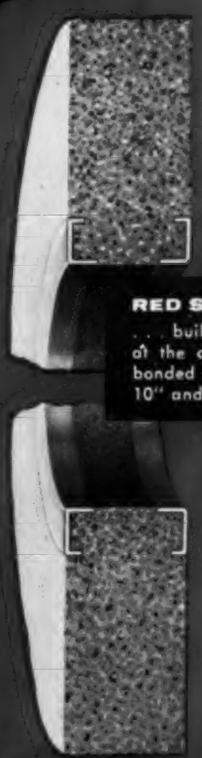
POLYSTYRENE

. . . injection molded plastic material replacing conventional lead bushing, chiefly for tool room wheels such as 7 x ½ x 1¼.



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STEEL INSERTS

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Better, more economical grinding! Simonds literally "centers" on this with these improved bushings. For you, this means better grinding efficiency . . . in terms of better spindle fit, better balance, truer running, less wear on spindles and center mounts and better work produced.

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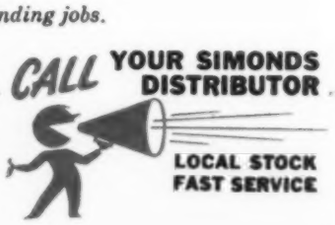

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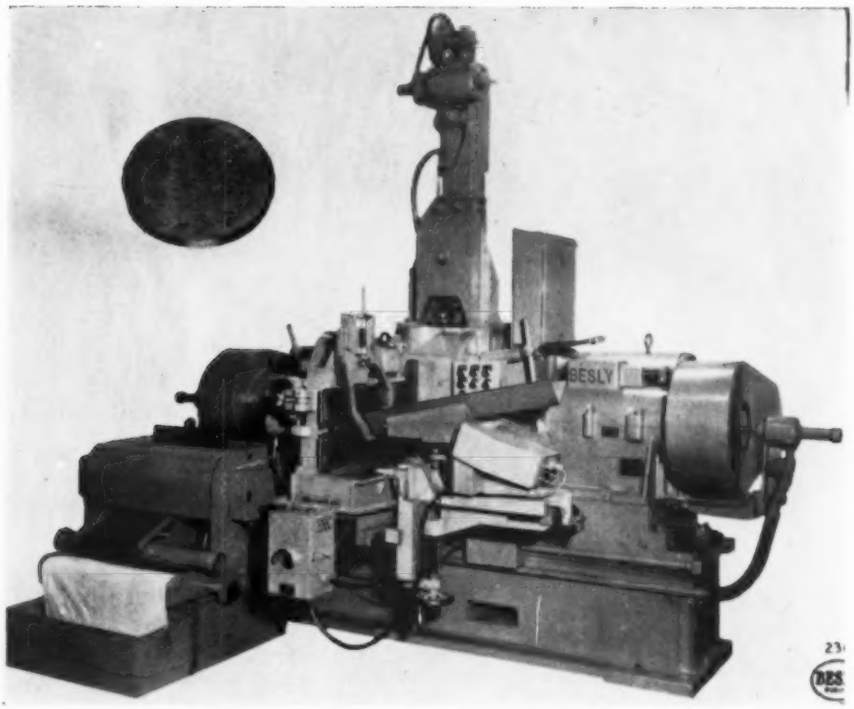

FIG. 1—Double disc grinder of the through feed type. You can feed 80 to 400 passes per minute with stock removal up to .030, .0004 for uniformity and parallel. (Besly-Welles)

Why you should know the full possibilities of . . .

Double Disc Grinders

- ✓ You can grind two sides of the product within .0003 for both parallel and uniformity
- ✓ Most any part with 2 flat sides can be ground on a double disc grinder
- ✓ Can grind products up to 4" diameter, 200 to 400 per minute with stock removal of .020
- ✓ Produces a better surface, greater accuracy, less warpage
- ✓ Finish looks and is flat

By **A. E. Salmons**
Tool Division, Dixon Valve & Coupling Co.

● The outstanding feature of double spindle grinders is their ability to grind two sides simultaneously, fully automatically. There are thousands of parts in many industries that could be double disc ground. Designers usually think in terms of cutting tools, and in many cases castings are made larger than necessary because depth of cut is of no great moment to the cutting tool. This is also done because scale of castings is sometimes destructive to tools. On the other hand grinding wheels cut through scale easily.

Production men agree that grinding is not an efficient way to remove large slices of stock. Yet if castings were designed for grinding there would be considerable savings in material. There are many cases where this saving in material would pay the labor cost of grinding.

Most any part with two flat sides can be ground on double disc. Two flat sides of unequal area can also be ground. Circular pieces from half inch to 15 inches can be ground on a continuous through feed. Flat stock and many odd shapes can also be

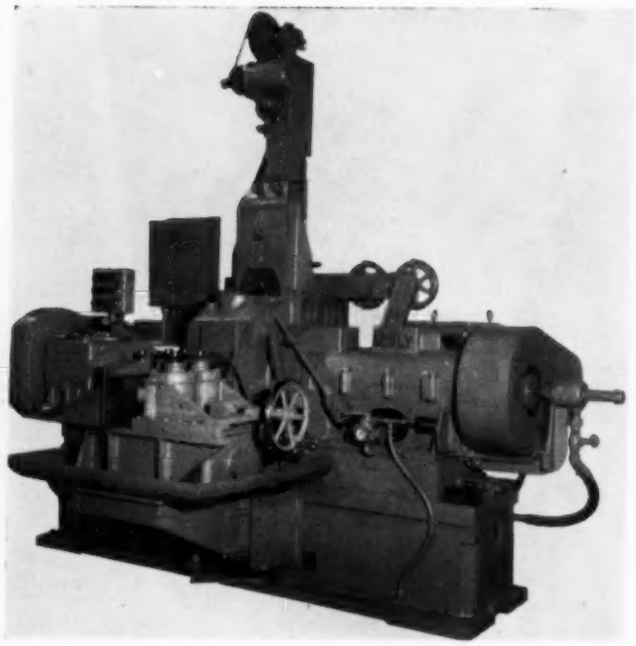

FIG. 1A—Another Besly-Welles double disc grinder of the through feed type.

ground fully automatically. Sizes above 15 inch are usually ground on special fixtures. Fig. 1 and Fig. 1A show two double disc grinders of the through feed type. On this type you can feed 80 to 400 passes per minute with a stock removal of up to .030, .0004 for uniformity and parallel. The wide variance in feeds is influenced by:

1. The material to be ground.
2. Amount of stock removal.
3. Area of contact.
4. Size or diameter to be ground.

I have personally ground circular products up to four inches diameter, 200 to 400 a minute with a stock removal of .020.

What Can Be Ground

Some of the products now being ground on a continuous feed are piston rings up to 15 inches diameter, steel spacing collars, washers of various diameters, bearing races, steel gears and many, many others. There are many other products that are double disc ground either fully automatic or by special fixtures such as blade spring pack retainers, steel thrust washers, brass booster rotors, nitralloy gear blanks, molded clutch facings, metallic packing collars, ends and sides of terra cotta tile, large and small coil springs, piston pins, aircraft engine valve inserts, alnico magnetos, pump vanes, carbon brushes, etc.

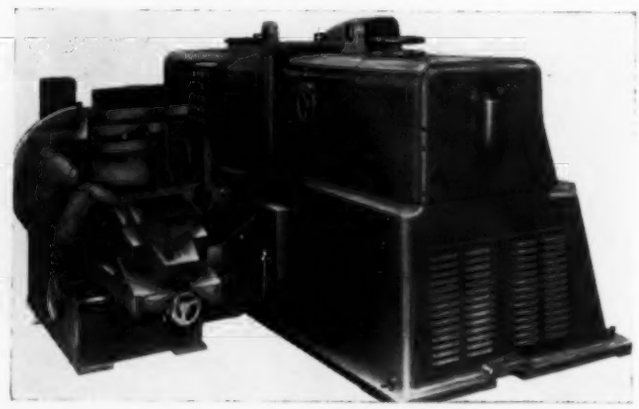

FIG. 2—Double disc grinder with roll around feed fixture.

Brass, bronze, cast iron, bakelite, chrome, plastic and hard rubber can be ground with equal success. There are only a few manufacturers of double disc grinders but if the fundamental factors that govern the operation are followed quality and quantity will result regardless of manufacturer. On double spindle, double disc grinding the discs turn in opposite directions. One spindle turns clockwise, the other counter-clockwise. Spindle speeds range from 750 to 1000 R.P.M. according to the make or manufacture. There are a few specialized machines with variable speed motors with a range 120 to 750 R.P.M.

Generally 24 to 36 grit grinding discs are used for rough grinding 50, 60, 80 grit for finish work. When very fine micro-finish work is desired 100 to 180 grit can be used.

I helped grind many thousand aircraft piston rings on a double spindle, double disc to very fine micro-finish. It is a good idea to check with the disc grinder manufacturer to supply grinding wheels for your type of work. My experience has been with many types of feeds. Here are a few of the continuous flow types where work is fed directly through grinding wheels:

1. Specially arranged belt and roll feed fixture.
2. A vertical trough which feeds work into endless belt. This belt carries work to an inclined trough and through two rubber rollers into guide plates into grinding wheels.
3. Work is loaded into a magazine or trough, and fed through guide plates, by chain, with cross bars or dogs. Cross bars depend on size of work.

There are numerous other types of feeds and in many cases they are interchangeable for various types of work:

1. Power oscillated double-end indexing fixture type.
2. The hydraulically operated swinging fixture.
3. The magazine weight feed.
4. Rotary work carrier fixture.
5. Roller gun type sliding fixture.
6. Roll around feed fixture. (See Fig. 2 for roll around feed fixture.)

This roller arrangement turns round circular work between grinding discs. It will do sizes up to 40 inches, within .001 for both parallel and uniformity.

Double disc grinding can be done wet or dry but recent trends are toward the use of coolants, as, at cooler grinds, more stock can get removed, and the finished surface is accordingly better.

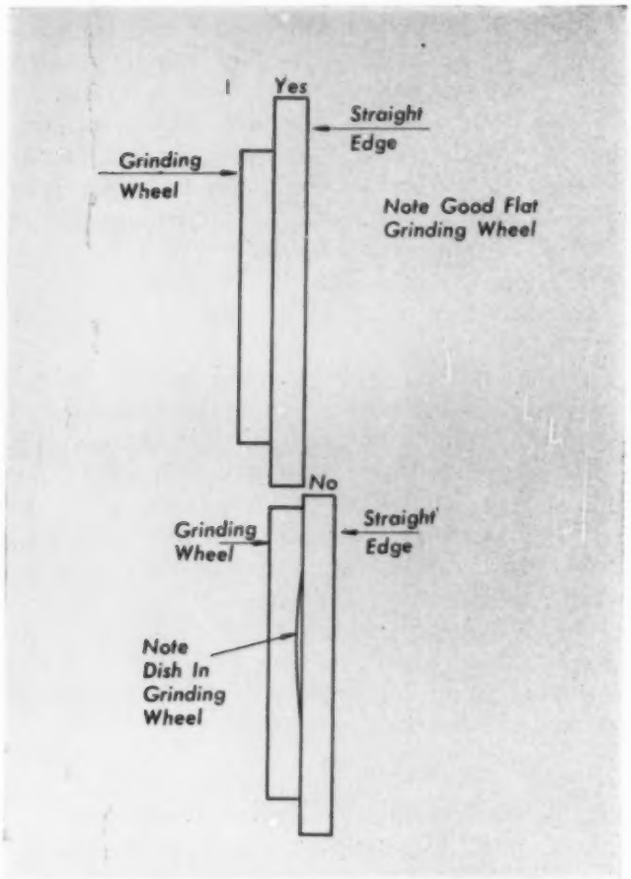

FIG. 3—Using a straight edge coated thinly with chalk. To check, slide gently over surface of grinding wheel.

Proper Dressing

First in importance in the operation of double spindle, double disc grinding is the correct method of dressing grinding wheels. In the more modern machines the dresser is power driven. The center of dresser should go to center of hole in grinding discs. Dresser should not dress more than .004 per pass on rough grinding wheels or more than .002 on the finishing wheels. Grinding wheels should be 90% flat for precision size grinding. Use a straight edge coated thinly with chalk; to check, slide gently over surface of grinding wheel as shown in Fig. 3.

Let dresser run up and down several times without removing anything from wheels at finish of dressing operation. If wheels are not flat there is an adjustment on dressing fixture. Grinding wheels will often run eight to 24 hours without redressing. For tough jobs or larger sizes, four to eight hours.

Do not redress grinding wheels unless the following conditions arise:

1. A spotty burnished appearance on work being ground.
2. A high glossy or glazed finish accompanied by increasing vibration of machine.
3. Breakage of work.
4. Variation in size and uniformity. Most common is variation in size.

All double spindle grinders are so arranged that work going all the way through grinding wheels are fed through guide plates into guide bars which extend past diameter of grinding wheels both at entrance and exit. These guide bars are pulled in a straight line with grinding wheels. This will prevent the grinding wheels from binding on guide bars. The guide bars should be set about one sixteenth over diameter of work being ground or one sixteenth over high side of flat stock. This will prevent work from binding on guide bars.

Guide bars should always be less in thickness than the thickness or width of work being ground, as follows:

Width To Be Ground	
1/16	.050 to .055
3/32	.080 to .085
1/8	.085 to .093
5/32	1/8
3/16	1/8 to 5/32
1/4	1/8 to 5/32
5/16 up	1/4

Guide bars should be of semi-hardened steel, but in cases where parts contacting guide bars are finished surface, brass or bakelite guide bars can be used. With proper care and alignment, the same guide bars can be used several weeks without replacing. As the lower guide bar does the most work sometimes just the latter is changed.

Many years ago a grinding engineer told me that double spindle grinders would never be entirely successful on account of the difference in S.F.P.M. between the outer and inner periphery of grinding wheels. The equalizing factor is that most of the grinding is done on the outer periphery of grinding wheels. Therefore, we do not need as much grinding area on inner periphery. On outer periphery we take a heavy cut and a rapidly diminishing stock removal to center of wheels. Work has reached approximate

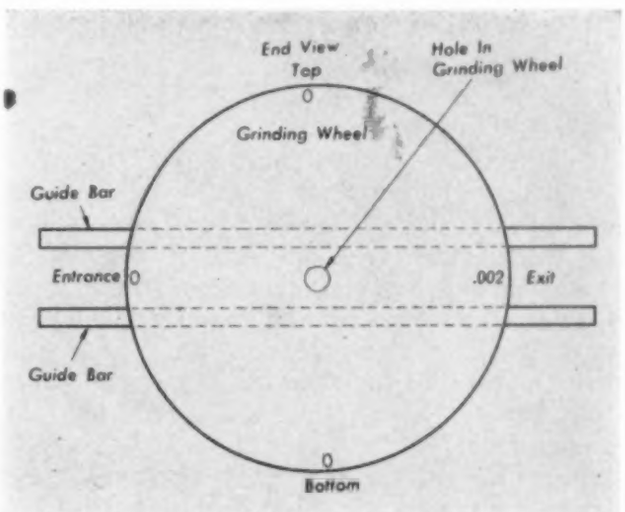

FIG. 4—Position of grinding wheels is important for a precision grind. If the feed is front-to-back on a horizontal line there should be .002 more opening at exit than at entrance. Top and bottom should be the same.

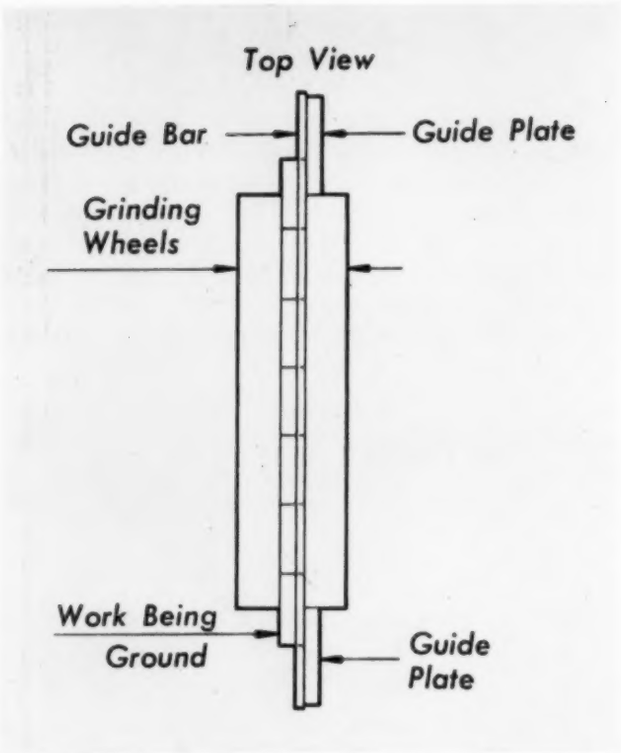

FIG. 5—Proper set-up for the positioning of grinding wheel with one type of feeding fixture.

size at center of wheels then falls out with a sort of lapping effect. I will explain this in another way.

Position of Grinding Wheels

Grinding is the action of thousands of grains that cut chips out of work being ground. The closer the work gets to the center of grinding wheels the nearer it becomes to the desired width. It can be seen then that the equalizing factor is that we employ less grains on inner periphery, but we also have considerably less stock to remove. This brings us to another important necessity for a precision grind: the position of grinding wheels. If the feed is front-to-back on a horizontal line there should be .002 more opening at exit than entrance. Top and bottom should be the same. (See Fig. 4.)

There is a wide variance of opinion even among the disc grinder manufacturers on the position of grinding wheels. I do know that this alignment will give a fast quality production where work goes all the way through grinding discs. In many of the specialized jobs there are various alignments of grinding discs. This depends on the metal and what part of the grinding wheels are used. There are so many feeding fixtures I could not go into all the various types but Fig. 5 will give you a general idea of a proper setup.

Piston rings and other circular products up to four inches are usually ground at feeds 150 to 400 per minute; variation and uniformity within .0003 after finish grind.

Stock removals vary according to sizes, material, and area to be ground. One piston ring company are grinding piston rings on double spindle grinders 6000 to 8000 passes per hour with one man only.

Quality and precision depend largely on properly dressed grinding wheels and alignment. Quantity depends on method of feed. The following rules apply to all makes of double spindle grinders, where work is fed all the way through.

1. Grinding wheels must be dressed flat.
2. Guide bars must be parallel with grinding wheels.
3. Guide plates, guide bars and grinding wheels must be so positioned that work enters and exits from machine without binding in any one place.

Many manufacturers are turning or milling one side at a time on products that could be ground more rapidly and economically. Double spindle grinding produces a better surface, greater accuracy, with less warpage.

Double spindle grinding produces a curlicue or criss cross finish that not only looks flat, it is flat. Improper set-up immediately shows shear marks or sheared finish besides poor size.

Recent Improvements and Future Possibilities

1. Simplified straight drive feeds.
2. Spindle speed adjustments for various new kinds of materials.
3. Automatic sizing devices.
4. Automatic feed loaders and conveyors.
5. Double line feed, twin spindle grinders.
6. A line of three or four machines that will feed from one to the other taking a cut on each.

The ideal set-up on double spindle grinders being ground in is to have as central a position as possible. This distributes the pressure evenly and tends to keep the grinding wheels flat. (See Fig. 6.)

Note circular pieces bunched in between guide bars all the way through grinding wheels. About half of these are down within a few tenths of finish size. That's the secret of precision sizes held on this type of grinder. What actually happens is the work has reached the desired size within a few tenths at the halfway point, at hole in center of wheels. From the center to exit they spin out removing a few tenths creating a lapping effect.

Some double spindle men claim that they get as good results when the opening in grinding discs is .002 greater at the entrance rather than at the exit. This is true especially when you run medium sizes at very fast feeds. Sizes within a few tenths can be maintained for both parallel and uniformity. However, if you try a feed slow for large size work it is pinched as it leaves the back end of grinding wheels. In this setting you get a shear grind instead of a spinning lap effect. It is necessary, however, that the grinding wheels have same opening at right angles to entrance and exit. Double spindle grinders

are equipped with size controls responsive at the slightest touch for tenth readings at both sides.

There are several types of manufacturers of double spindle grinders and a step-by-step description could not be made to fit all makes. However, there are eleven fundamental factors that cover most all makes of the through-feed type:

1. Open both heads until grinding wheels are in dressing position.
2. Lock in this position which is now in size control.
3. Remove top guide bar, lower bottom guide bar.
4. Bring each grinding wheel in until it touches dresser.
5. Start power dresser removing approximately .002 to .003 on each grinding wheel to center of wheels.
6. Continue 4 to 5 passes then let dresser go up and down two or three times without removing any grains.
7. Raise bottom strip, replace top strip and set 1/16 over size of work you are going to grind.
8. Bring grinding wheel in until it touches guide bars on the side where the guide plates are stationary.
9. Hold work flat on stationary guide plate and slide it gently on guide plate until it touches grinding wheel. Grinding wheel should extend about .004 to .006 beyond guide plate.
10. Bring other grinding wheel in until it fits the approximate width of work you wish to grind "snug fit."
11. Start machine and feed using size controls until desired size is reached.

The ability to grind two sides of a product with double spindle grinders within .0003 for both parallel and uniformity is well recognized in the piston ring industry. Many other products are also being ground at feeds 200 to 400 per minute where the grinding area is small. This includes other circular work pieces with wide wall thickness or flat work with large grinding areas at speeds of 50 to 100 a minute. Double disc grinding would be used on a much wider scale if its capabilities were more widely known.

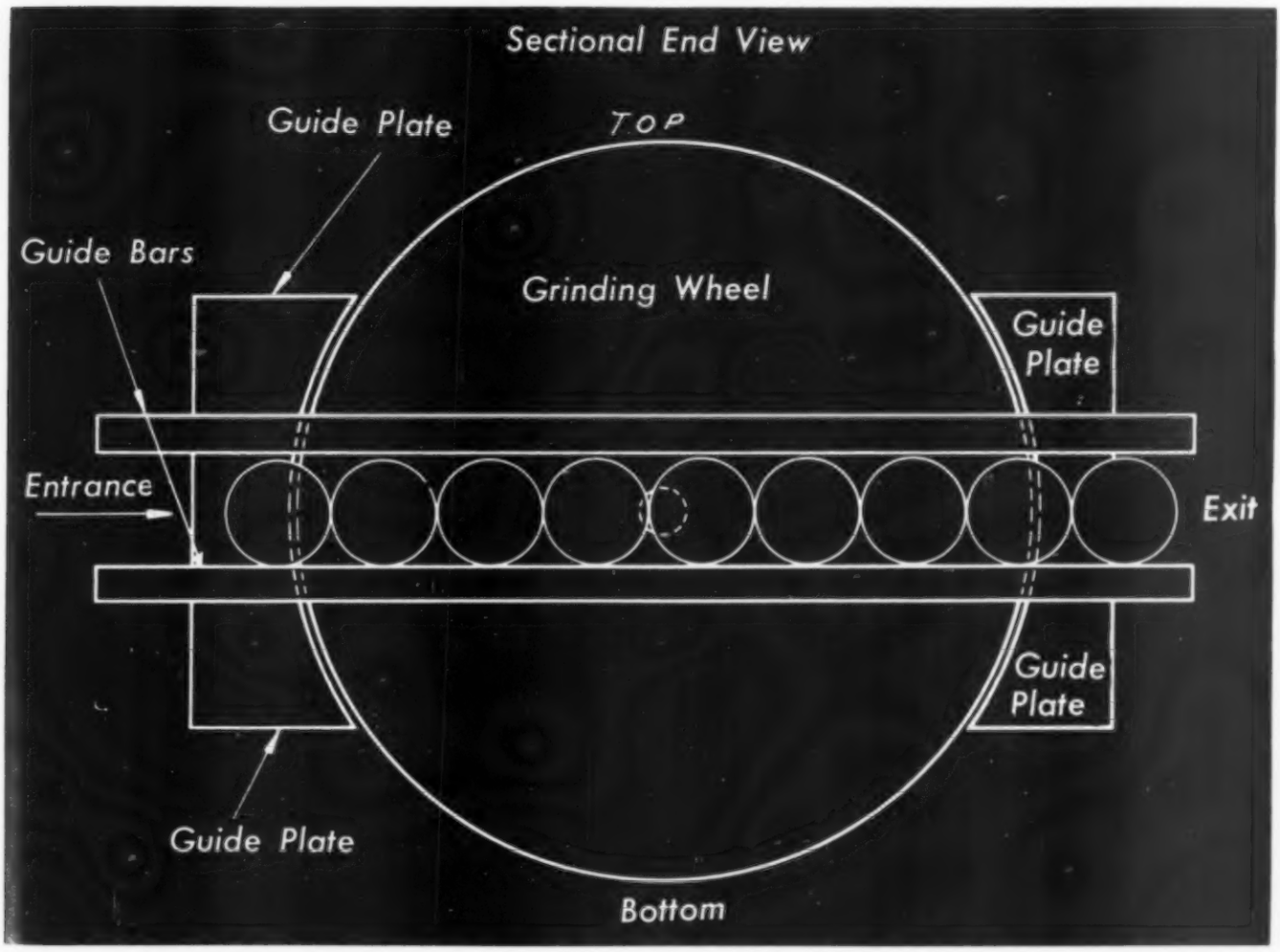

FIG. 6—The ideal set-up on double spindle grinders being ground in is to have as central a position as possible. This distributes the pressure evenly and tends to keep the grinding wheels flat. Note circular pieces bunched in between guide bars all the way through grinding wheels. Work reaches desired size within a few tenths at halfway point.

Want to be

A Diamond Wheel Expert?

It's all a matter of keeping a day-to-day record of wheel performance. Here's how to do it . . .

RECORD OF GRINDING WHEEL

MAKE _____ MACHINE _____

SIZE _____ WHEEL SIZE START _____

GRIT & BOND _____ WHEEL SIZE FINISH _____

TYPE _____ WHEEL WEAR _____

DATE	PART SIZE START	PART SIZE FINISH	NUMBER OF PIECES	TOTAL STOCK REMOVAL	WHEEL WEAR IN .001	REMARKS

By O. K. Hittenberger,
Supervisor, Methods & Planning
Carboloy Department, General Electric Company
Detroit, Michigan

● You can be both author and critic in your own story of economics. In this story carbides and diamond wheels are the principal characters.

Expert handling of the two characters does not take years of training, yet can save you many dollars in a relatively short time.

As a carbide user or fabricator, you know that diamond wheels make up a good portion of your operating budget. Making yourself a diamond wheel expert is simply a matter of keeping a day-to-day record of wheel performance.

Evaluating Test Records

First thing to do is to devise a simple method of testing, using, maintaining and finally evaluating. The key to dollar savings is this evaluation of your test records.

A test record sheet, such as shown here, is easily constructed and duplicated. The format allows for such basic data as make, size, type, grit and bond, machine, wheel size start, wheel size finish and total wheel wear.

For each order you record the data listed below the format—namely, date, part size at start, part size when finished, total stock removal and a column for recording wheel wear by job lot. A "remarks" column may be provided for notations as to the day-to-day performance of the wheels and coolant used.

Test records start with a newly mounted wheel which you believe will do the job, or one which your diamond wheel manufacturer has recommended.

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PARKER-MAJESTIC, INC.

147 Joseph Campau, Detroit 7, Michigan

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After "trueing" the wheel on the adaptor with an indicator, measure the depth of diamond. If the test wheel happens to be a circular wheel, you need only to measure accurately the diameter and record on test sheet. Once the wheel is mounted on the adaptor, do not remove until wheel is worn out. If adaptor with wheel must be removed from spindle for measuring, it would be well to mark the end of the spindle and the adaptor so that the assembled wheel can be placed in same position on the spindle. This will compensate for any spindle run-out.

Next, sample check some parts to determine stock removal. Here, you may want to either record stock to be removed in thousandths of an inch or calculate the cubic inch of stock removal for the order.

When the wheel is entirely worn out, you add the total stock removal for all jobs. Whether you recorded your stock removal in thousandths of an inch or in cubic inches, divide this figure into the cost of the wheel for the answer you want.

If the wheel you are testing is going to be used on only one type of job, you may only want a diamond wheel cost per part. In this case, you record total of parts ground for life of the wheel, and divide into your wheel cost.

Coolants are an essential part of diamond wheel life. Soluble oil can be a base substance, but should have a fairly high mixture of water with a rust inhibitor added. Your coolant must be of a type that will keep the wheel clean and free-cutting as well as act as a cooling agent. Use coolants as liberally as your equipment allows.

The life of your wheel can be greatly affected by how it is used. Wheel manufacturers recommend certain "use" directions which, generally, should be followed. However, after a series of tests, you may find it possible to deviate from them and obtain a lower wheel and labor cost.

What Test Records Can Do For You

Let us summarize just what diamond wheel test records can do for you.

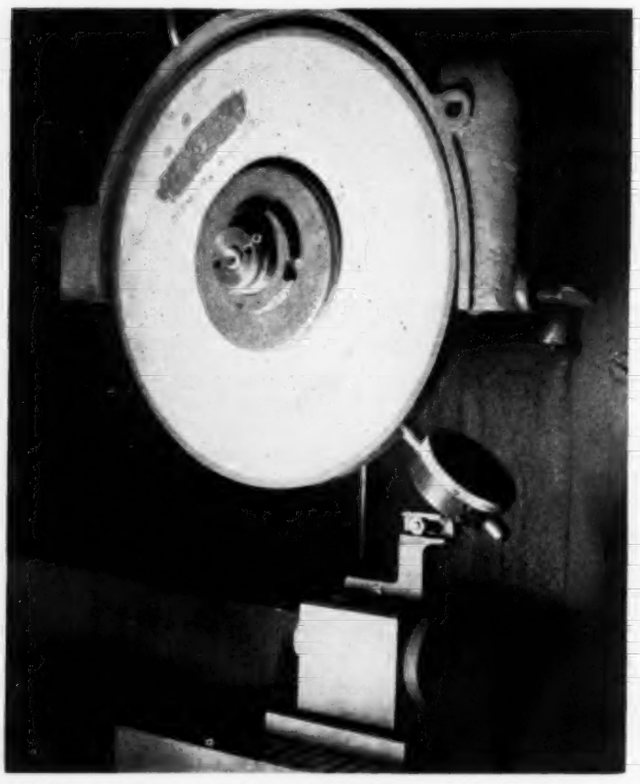
First, by surface finish obtained and the cutting action of the wheel, you can determine if a coarser grit or harder wheel can be used. If so, longer life can be expected with the resultant lower cost.

Second, you obtain a wheel cost to apply to a given stock removal either for future wheel test evaluation or a diamond wheel cost for job estimating purposes.

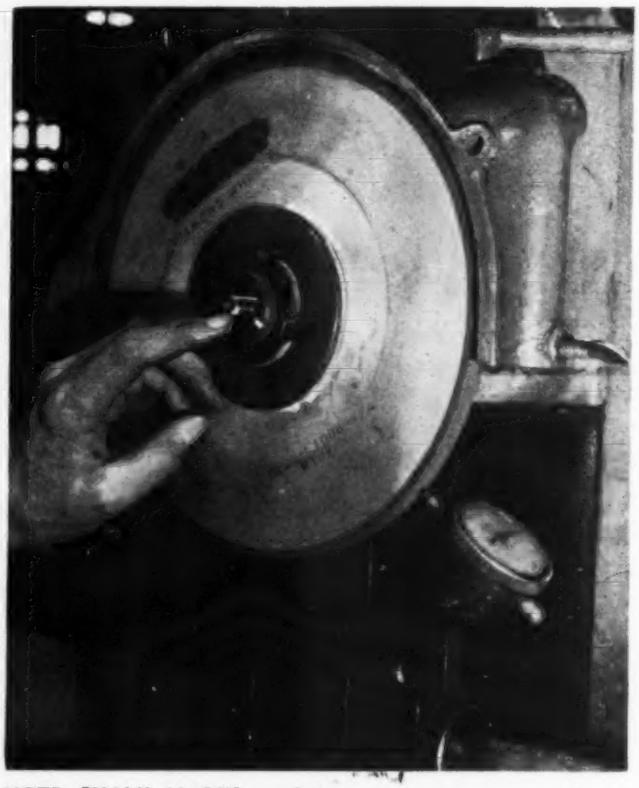
Third, test records allow for coolant evaluation and, **fourth,** you can evaluate changes in feeds and speeds or any other changes you believe will improve costs.

In our plant, we cut our centerless grinding costs by more than 50 per cent through the use of test data. The data contributed to specification changes, coolant changes, increased feeds and speeds and allowed for some mechanization.

The time to start in making diamond wheel tests is now. Your savings will far outweigh the effort. After only a few such records, you not only can be an expert, but also an expert operating budget administrator. ●



HOW DIAMOND WHEEL IS "TRUED" with indicator after being mounted on adaptor.



NOTE CHALK MARKS used here to assure re-assembly of diamond wheel in same position on spindle.

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Lubrication or Cooling?

Which is more important in a grinding fluid?

Recent research by the Grinding Wheel Institute points the finger on lubrication as the more important function of grinding fluids

This article summarizes important findings from the paper "Influence of Grinding Fluids upon Residual Stresses in Hardened Steel" by Dr. H. R. Letner, presented at the annual meeting of the American Society of Mechanical Engineers. This research was sponsored by the Grinding Wheel Institute and the Abrasive Grain Association, conducted at Mellon Institute as part of a $250,000 research program into the effects produced on metals by grinding.

● Fluids used during a grinding operation can be expected to affect the surfaces being ground. These effects have been carefully analyzed, using 13 different fluids. The results suggest that the effectiveness of a fluid in minimizing residual grinding stress depends not so much on the heat relieving capacity of the fluid, but the degree of lubrication furnished between the fluid and the work.

Two of the most important functions of a grinding fluid are cooling and lubrication. Cooling protects the abrasive wheel against mechanical or thermal stressing of the bond. Cooling the work results in a stabilized depth of cut by the wheel. Lubrication, on the other hand, tends to reduce wheel face loading, glazing of abrasive grains, and most important **the friction between the wheel and the work.**

Since either of these two functions may have a bearing upon plastic deformation by grinding, it is possible that residual stresses induced by grinding are influenced by the grinding fluid employed. Previous work using oil-water emulsions, straight grinding oils, and air, has borne this out.

The grinding experiments discussed in the Letner paper were performed in the following media:

1. Air
2. Two different concentrations of rust inhibitor in water

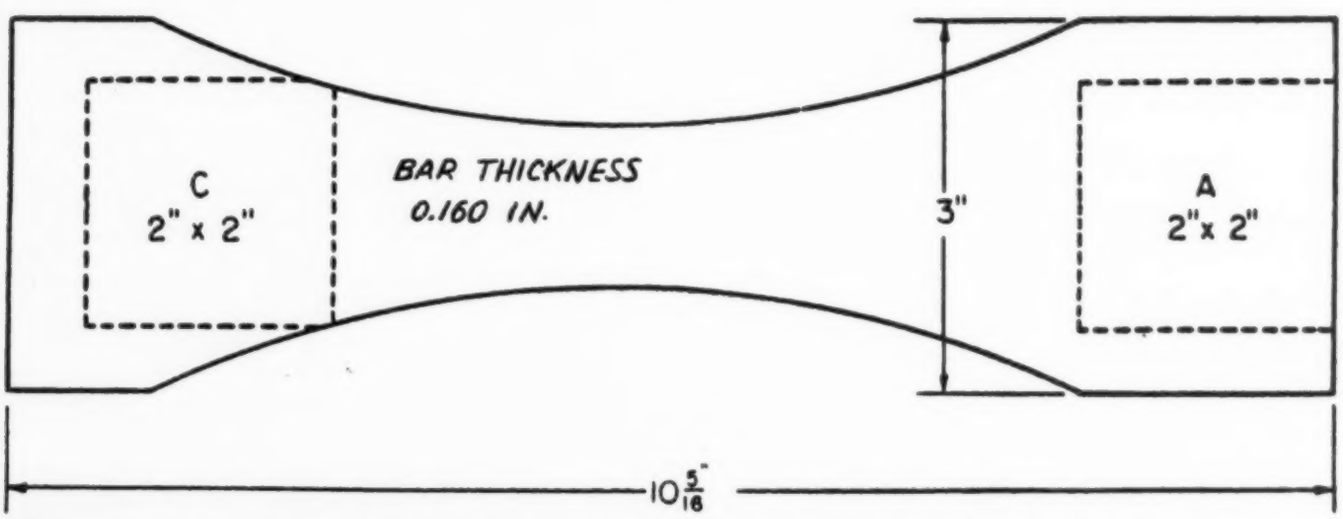
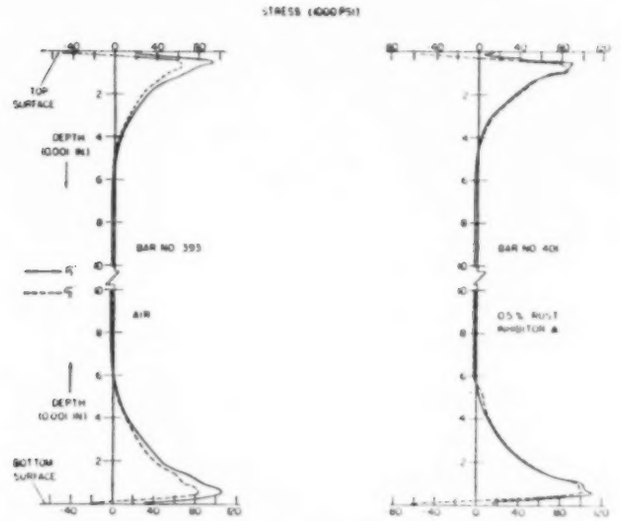


Diagram of test bar showing positions A and C from which specimens for stress measurement were cut. Bars for these studies were of AISI 52100 bearing steel, Rockwell C 59.



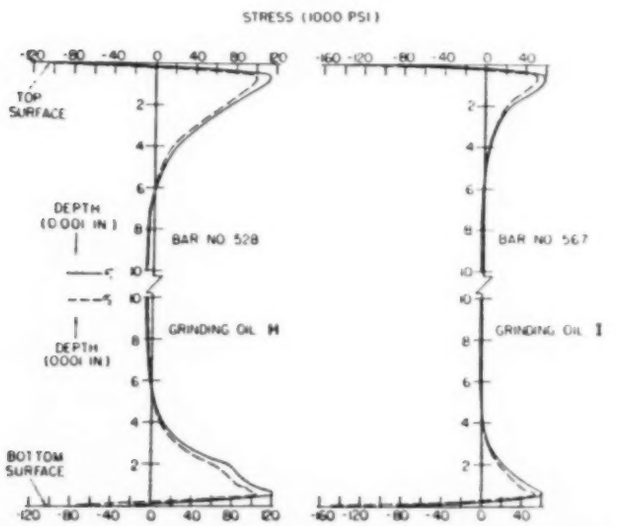
Comparison of residual stresses resulting from dry grinding with those obtained using a 0.5% concentration of nitride inhibitor in water, showing the negligible advantage of cooling alone in preventing grinding stresses.

3. Six water miscible oils (soluble oils)
4. Four straight grinding oils

Specific aim of the research was to study the effect of grinding fluids upon residual stresses induced in hardened steel by surface grinding, and their effect on fatigue life. Steel used in the experimental procedure was of a ball-bearing type, AISI 52100. Its composition:

1.01 C	0.37 Si
1.25 Cr	0.011 S
0.27 Mn	0.011 P
0.19	Remainder Fe

Test bars used in the surface grinding experiment were 10-5/16 x 3 x 0.160 inches—of the flat fatigue type. They were RC 59, annealed for four hours at 1000-1100°F between heavy flat steel plates, austenitized 15 minutes at 1550°F in a salt bath, quenched in oil and tempered for two hours at 450°F.



Residual stresses obtained using two of the straight grinding oils tested, indicating the variation in stress concentrations which occurred in this grinding fluid category.

Crossfeed grinding was employed in the tests using an 8 x 0.75 x 1.25 medium grade and structure wheel, with 46-grit aluminum oxide abrasive in a vitrified bond (38A46-J8VBE). Wheel was mounted on a horizontal spindle, reciprocating table type of surface grinder.

Surface speed of the wheel was 6000 sfm, traverse speed 60 fpm, crossfeed 0.050 in. per traverse and unit downfeed 0.001 in. per complete crossfeed. Grinding fluids were fed to the periphery of the wheel in a conventional manner.

Results and Conclusions of the Study

There are indications from various other research not summarized in the Letner paper that compressive stresses at the surface of a part are beneficial to the service life of that part. Tensile stresses, on the other hand, are generally regarded as harmful.

Stresswise, water solutions of rust inhibitor or soluble oil have little advantage over dry grinding for the wheel, feeds and speeds tested. The fact that stresses obtained with essentially pure water (0.5 per cent rust inhibitor) are substantially the same as those resulting from dry grinding indicates that the heat capacity of the fluid has little effect on the stresses. Grinding stresses are the result of mechanical and thermal stresses in the workpiece associated with chip removal by the abrasive. Thus the important benefit derived from a grinding fluid is due to a reduction in the thermal component, and it must come from **reducing the amount of heat generated rather than carrying it away later.** This conclusion is consistent with previous research. In metals, at least, the workpiece apparently absorbs the surface heat so rapidly that any subsequent cooling by the fluid is of minor importance.

Although the wheel, feeds, speeds and work material used in the Letner study are typical of conditions to be found in commercial practice, no claim of generality beyond the scope of the present experiments is made for the following conclusions:

1. Stresses obtained with water solutions of rust inhibitor or miscible oils differ very little from those resulting from dry grinding.

2. Some reduction in magnitude of the peak tensile stresses is indicated by certain straight grinding oils.

3. Straight grinding oils are conducive to high compressive stresses very close to the surface.

4. The effectiveness of a grinding fluid, as far as residual stresses are concerned, depends upon its ability to reduce thermal and mechanical stresses during chip formation, rather than upon its ability to carry heat away from the cutting zone after it has been generated. That is, in terms of the generally recognized functions of grinding fluids, lubrication is more important than cooling. •

WRONG . . .

OPERATOR WORKING WITHOUT GOGGLES—safety glasses lacking side cups are not considered adequate protection against flying particles in grinding operations—attempts to hold small bushing in his fingers at a point a few inches above the work rest. Danger of finger abrasions is added to impossibility of accurate grinding of small piece.

GRINDING Safely

by **Edmund Mottershead,** President

Mottershead Associates

Chicago, Ill.

Check your machine, and check yourself every time you approach a grinder. That way, you will never have the kind of accident so frequently caused simply by being in a hurry and being careless.

First, have your eyes protected whenever you approach a grinder. This means goggles with cups or a face shield. If the grinder has a glass shield, be sure it is in place and not cracked or broken.

Then make sure the grinder isn't running. Next check the work rest—⅛" from the wheel surface, no more, to prevent getting either the work or your fingers caught between work rest and wheel.

Next check wheel mounting. There should be a flange on each side of the wheel, preferably with a paper or rubber or leather washer the same size or larger.

If the flange appears at all sprung, you should not start the wheel at all; report the condition to the supervisor and get the wheel mounted right before using it.

Next, check the guard. Good guards have been installed on almost all wheels, but as a wheel is worn down in use, the space between the wheel and the edge of the guard increases. On some wheels, there is an adjustable tongue at the top of the guard. The space between the face of the wheel and this tongue should be no more than ¼ inch.

The grinder is such a familiar piece of equipment in most shops that we are often prone to overlook the simple and easy steps necessary to insure safe and efficient operation of the machine. Every man feels perfectly competent to operate a grinder, even without instruction—and with sometimes tragic results. A quick check of these essential points of machine condition before operating the wheel will save time, save tool and wheel breakage, improve your grinding and improve your safety record.

RIGHT . . .

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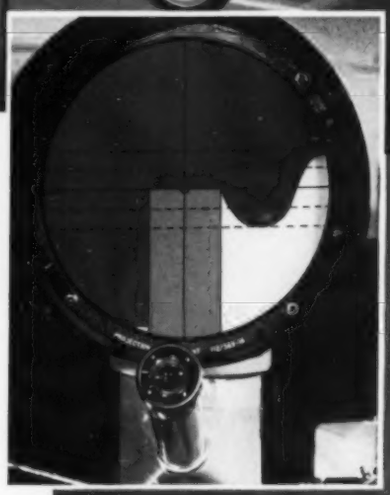

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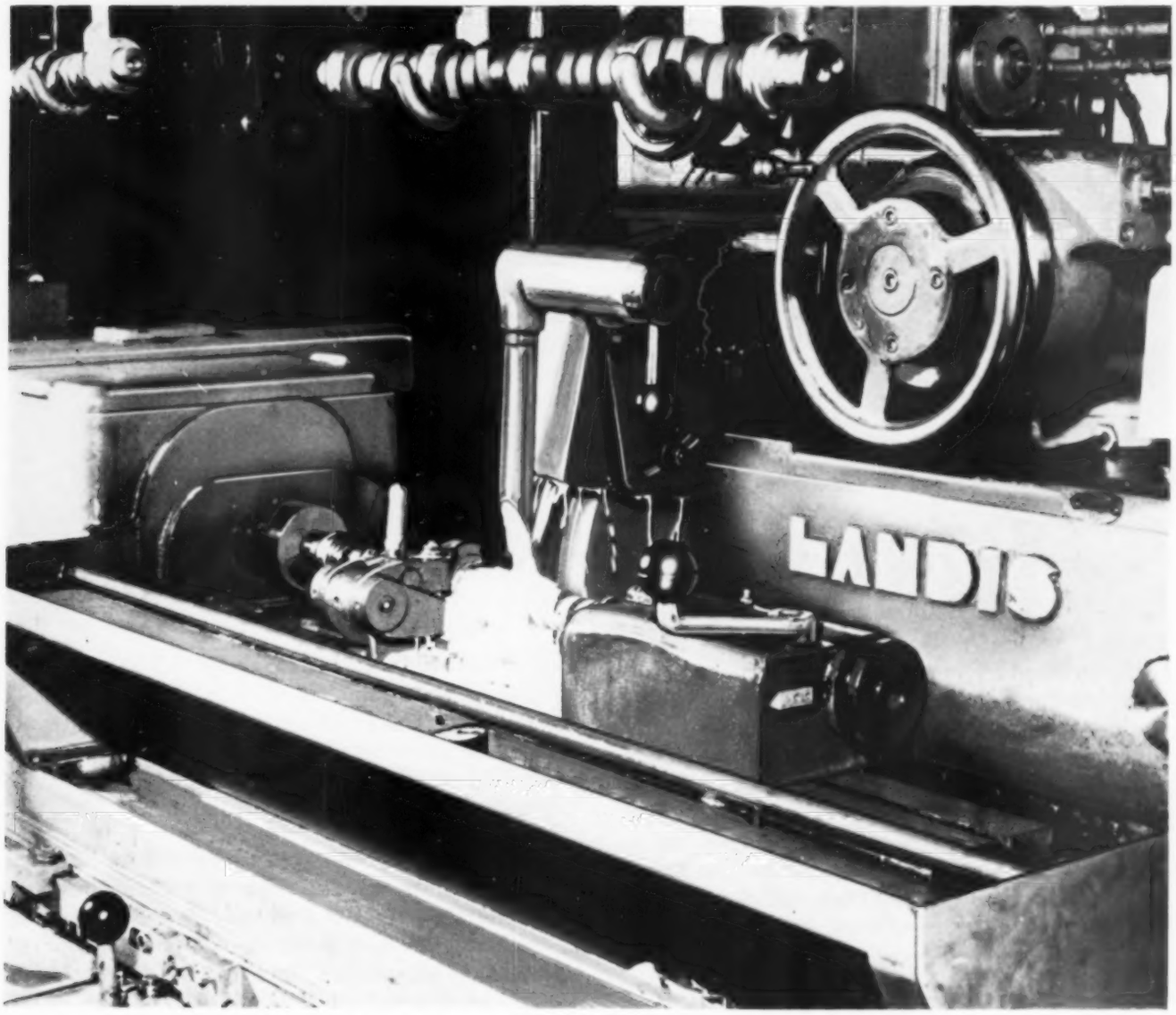


Fig. 1. Finish grinding cam lobes of Plymouth V-8 camshaft.

What's involved in engineering the proper

Diamond Dressing Tool

Here's how it was done at Plymouth . . .

. . . they got all the necessary facts about the job the tool was expected to do

. . . they carefully selected a diamond best suited to the task

. . . they designed a toolholder that best presented the diamond to the wheel

By **D. J. Wallace,** Vice President
Wheel Trueing Tool Company

● In the case histories presented here, some of the jobs themselves are fairly routine. However, the type of diamond tool selected for the task will be unique. In other cases, both the job itself and the diamond tool will be decidedly specialized and unusual.

On each of these jobs we were called in to consult with the process or tool engineer about the specific tool involving an industrial diamond which would best solve his production problem. Sometimes it was obtaining a high volume of output, with only minor regard for other factors. In another case,

maintenance of a critical tolerance or reducing machining costs was the problem. By knowing the particular problem to be met, we have been much better able to recommend tools to do the job and the customer gets far better results.

With tolerances in 10ths and half 10ths becoming commonplace, the diamond is probably the **most important single factor** in precision grinding! We were recently told by the superintendent of the new Plymouth V-8 Engine Plant in Detroit, that the cost of waste rag for wiping considerably exceeded the total expenditures for diamonds, yet without the diamonds, virtually all of the precision grinding would be impossible.

Because of the wide interest in the Plymouth V-8 engine plant, I chose it as the subject of these job studies.

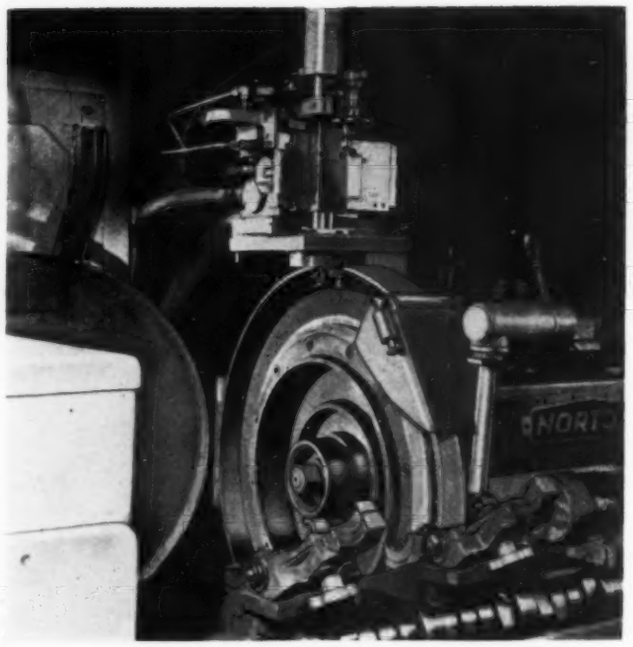


Fig. 2. Automatic wheel trueing device for cam grinder.

Finish Grinding Cam Lobes

In this first set-up in figure 1, you see the grinding of the 16 lobes of the cam shaft. **Rough** grinding is done on Norton DH automatic cam grinders while **finish** grinding is done on Landis grinders. The grinding operation itself is fairly routine for automotive engine work. However, every possible step has been taken to make the grinding **automatic.** A unique overhead conveyor system continuously feeds castings to the batteries of grinders. You see one of these conveyor brackets here. This has eliminated stock-piling in the Plymouth plant and the necessity for fork trucks to transfer work between grinding operations.

On both rough and finish grinding, 24 x 3/8 x 18 in. wheels of aluminum oxide with vitrified bond are used. "O" grade wheels are used in both operations with 60 grain for roughing and 90 grain for finishing. After removing .050 to .070 in. of stock in roughing, the cams are replaced in a conveyor bracket to move on to the finishing stations. There an additional .010 to .015 in. stock is removed and a finish of 10 microinches is maintained.

As you know, grinding cast iron tends to load the wheel rather quickly and requires frequent dressing. To meet the need for a smooth flow of materials, a method of dressing the wheel without interrupting production was sought. Since many of the operators would be semi-skilled, it was also important to relieve these men of the responsibility for these more critical wheel dressing techniques.

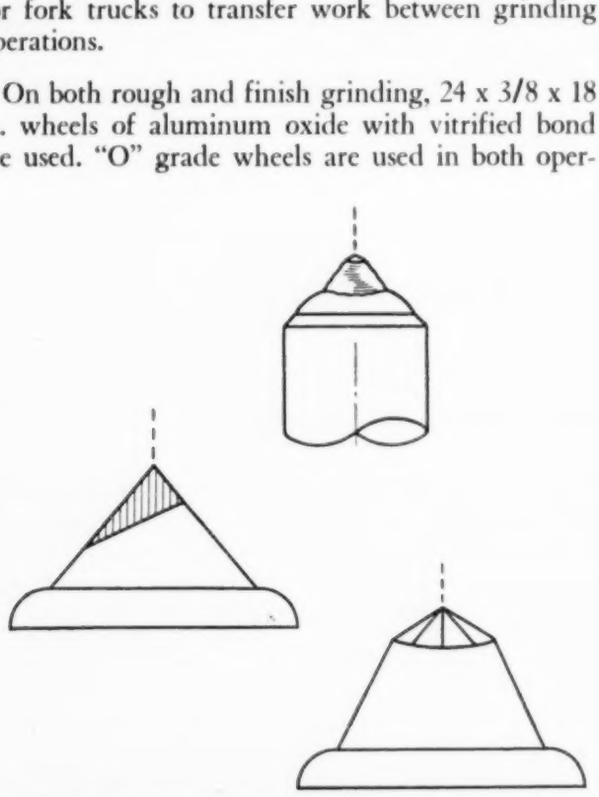


Fig. 3. Illustrating advantage of automatic indexing device.

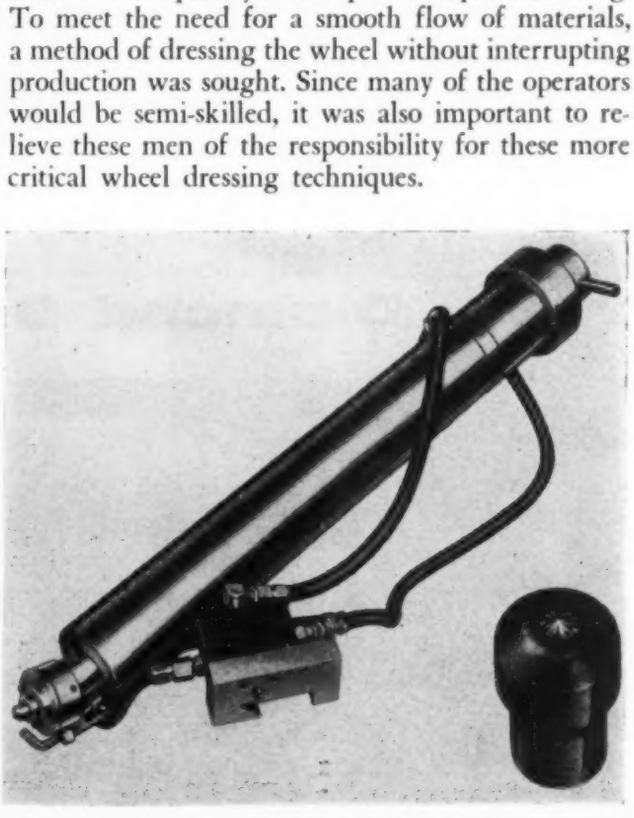


Fig. 4. Hydraulic diamond turner used in Plymouth plant.

Indexing the Diamond Tool

In figure 2, with the wheel guard opened, you can see our automatic diamond turning device which we recommended for the job. The wheel is automatically dressed after each cam grinding cycle. This dresser is essentially a hydraulically actuated tool-holder unit which operates from the hydraulic system of the machine. It automatically indexes the diamond tool a prescribed number of degrees after each dressing. It makes efficient wheel dressing the normal for every machine and every operator.

Usually, the dressing of a 60-grain wheel of this size would require a 1 to 2 ct. diamond tool. However, with automatically controlled indexing we are able to recommend smaller diamonds. For instance, diamonds under 1 carat are used in these tools. In addition to the savings in the cost of the diamonds themselves, we've found the smaller diamond in the automatic turner to be more effective in maintaining an open, sharp grain. With the conventional single-point diamond tool, relatively large flat surfaces quickly develop. The edges of this flat become dulled and ineffective in fracturing the wheel grains. The wheel requires more frequent dressings; production suffers and costs rise.

The simple drawings in figure 3 show the principles involved in the automatic indexing device. Normally the grain structure of a diamond converges at the tip of the diamond. (See natural shape diamond illustrations.) If this **tip** is presented to the wheel, the diamond wears quickly **across** the grain, where wear resistance is lowest. You've probably all seen diamonds used this way and quickly worn to a useless flat surface. The flat not only fails to do a job of cutting, but it also rapidly builds up heat which may cause the diamond to be burned or even result in permanent damage to the diamond.

The automatic diamond turner is designed to present the **rib** or side of the facet to the wheel so that wear is along the **length** of the grain, where wear resistance is highest. The point of the natural shape, select octahedron diamond is turned slightly for this tool to facilitate formation of the facets (see tip).

By metered indexing of the diamond, new facets are continually being developed and new edges being sharpened as illustrated here (notice facets). Maintaining this rib, which contacts the wheel, in a sharpened condition gives ideal wheel grain fracturing, with a very minimum of grain removal from the wheel. Moreover, it keeps the grain open and free of metal.

By developing these sharp edges, the automatic diamond turner also permits lighter infeed in wheel dressing. This extends the grinding wheel service as well as the diamond tool life.

Figure 4 is a photograph of a diamond tool which has been used in hydraulic diamond turner showing how uniformly the diamond is shaped from the point

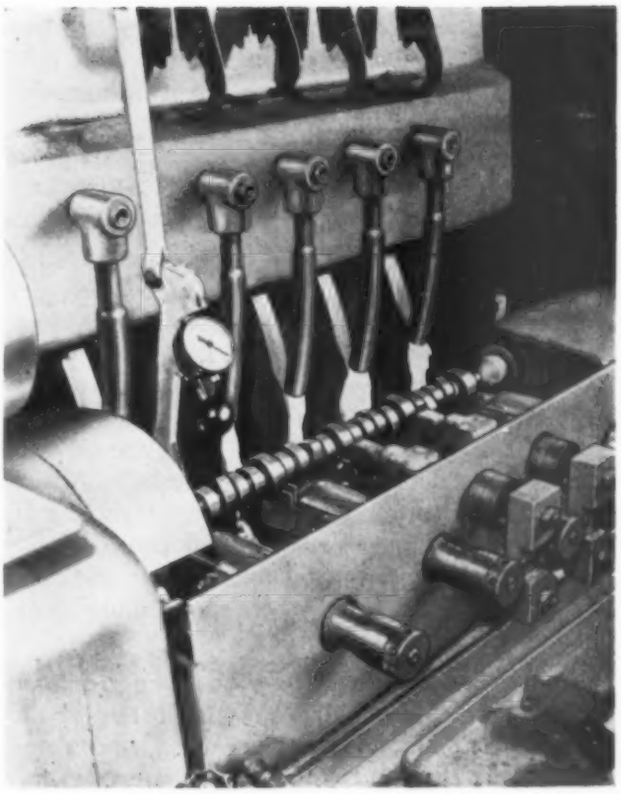


Fig. 5. Landis six-wheel grinder for grinding camshaft main bearings, equipped with wheel-type diamond tool.

back. You can also see some of the detail of Wheel Trueing's hydraulic diamond turner used at the Plymouth engine plant. At Plymouth, the diamond turner, on both Norton and Landis machines, is set to index the diamond 7½° after each dressing. This setting of 7½° develops 48 perfect facets on the face of the diamond in a complete revolution of the tool.

Grinding the Cam Main Bearings

Moving down the line from the cam **lobe** grinding, figure 5, we find a group of Landis multiple-wheel grinders for grinding the **cam main bearings.** Roughing the five main bearings and the gear blank is done on six-wheel Landis IW cam grinders with finishing of the main bearings on five-wheel units.

In this picture, you can see the location of the cam shaft in the fixture as the oscillating wheels remove .012 to .015 in. stock in the **finish** grinding. Diameter tolerances of plus .010, minus .000 in. are maintained, with concentricity and out-of-round condition held to .0001 in. When any bearing exceeds these tolerances, **all** the wheels must be dressed to give uniform grinding performance. Since all wheels are on a common spindle, wheel diameters must be kept uniform to obtain identical bearing diameters. With grinding wheels 35 x 1-1/8 expected to hold such tolerances with a 15-18 microinch finish, performance of the diamond tools is exceptionally important.

You can see here the wheel-type diamond tools

with calibrated in-feed for the precision wheel dressing. Conventional single-point diamond tools failed to give at top production speeds grinding wheel finishes that would maintain the tolerances and finish required. With the single-point dressing tool, out-of-round and tapered conditions occurred to create a bottle-neck in the smooth flowing production line.

A wheel-type diamond tool was recommended for the job to correct this difficulty. As the wheels oscillate across the machine, each wheel is individually dressed by its own diamond tool. In figure 6 you see a detailed illustration of this tool. For this particular application, 16 carefully selected and matched elongated shape diamonds, totalling 2 cts., are set in the matrix, four diamonds on each of the faces. All four diamonds contact the wheel simultaneously in a vertical position. This wheel-type tool provides about the same advantages as the automatic diamond turner and is used on machines where space limitations do not permit use of the turner.

Rather than the single edge of a larger diamond contacting the wheel, we have here four smaller, yet sharper, diamonds to fracture the wheel grain. And as the diamonds in each face are consumed, the tool head can be changed to present a virtually new dressing tool. This, of course, eliminates down-time for changing tools and permits uninterrupted production.

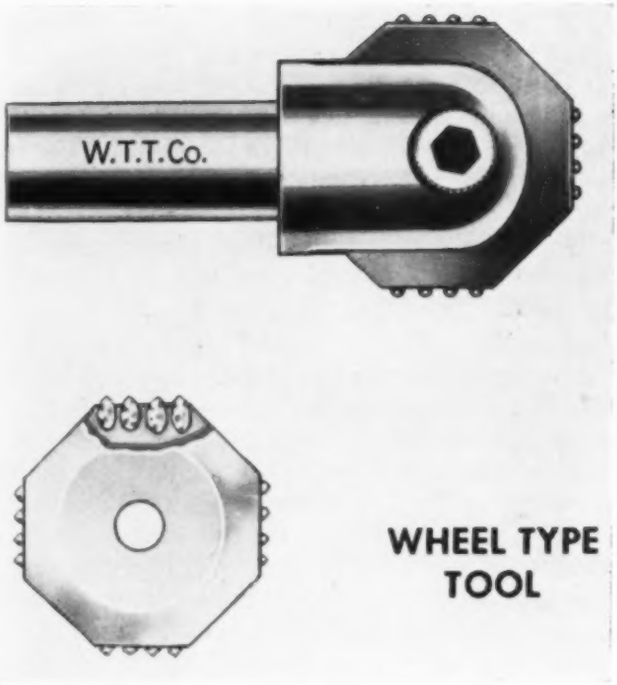


Fig. 6. Wheel-type dresser employed on cam bearing grinder.

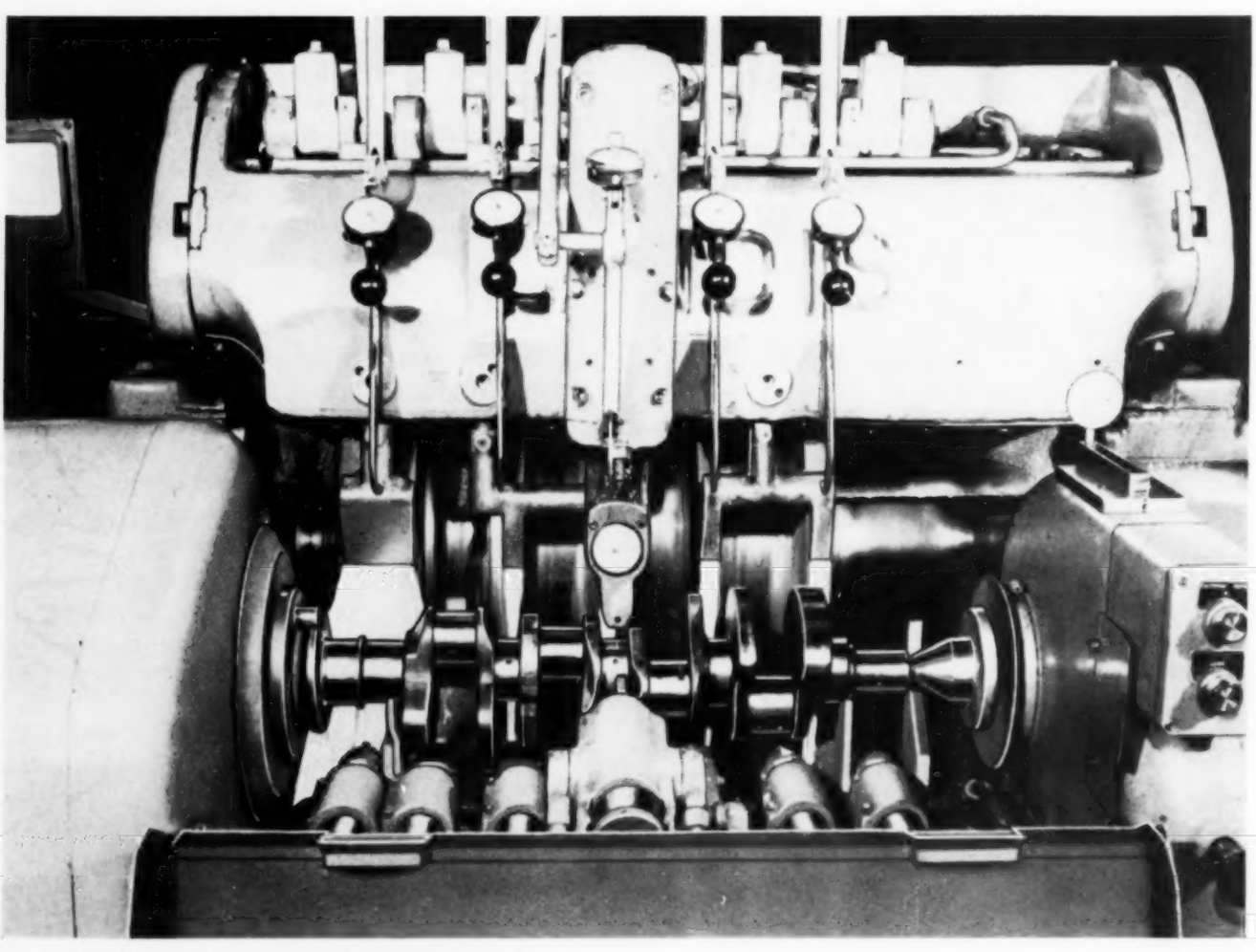


Fig. 7. Crankshaft grinder uses six blade-type dressers.

Fig. 8. Positioning of diamonds in matrix of blade dresser.

Fig. 9. Special blade dresser specified for finishing.

Battery of Crankshaft Grinders

Along the 4500 feet of **crankshaft** automation line at the Plymouth V-8 engine plant, we find a battery of Landis IW crankshaft grinders simultaneously machining the five main bearings and the oil seal, figure 7. The conveyor system coupled with built-in loaders and unloaders on the machines themselves has eliminated the fatigue and drudgery hitherto associated with crankshaft machining.

Just as on the multiple wheel **cam** grinders, these **crankshaft** grinders have an individual gage for each grinding wheel. Here too, occurrence of any diameter that exceeds the .0002 in. tolerance calls for the immediate dressing of all wheels to a uniform diameter. The special gage at the left of the figure is used to facilitate the dressing operation by indicating the distance from the wheel spindle to the point of work-wheel contact.

Plunge grinding is done with 60 grain, "0" graded wheels, again of aluminum oxide, vitreous bond. They are 42 in. diameter wheels, varying in width from .991 to 1¼ inches. Here in the **roughing** operation, .030 in. stock is removed from the six work surfaces.

Wheel Trueing Blade-Type Diamond Tool

Six calibrated in-feed barrels for the diamond dressing tools are used. Originally, these machines were equipped with single-point diamond dressers, but these tools failed to give the desired results. Again, as in the grinding of the **cam** main bearings, an automatic diamond turner would have been ideal, but space limitations on the machine prohibited the use of the hydraulic unit. In this case, a patented Wheel Trueing blade-type diamond tool was recommended. We call this tool 3-3-3. It consists of three overlapping layers of carefully selected and matched elongated type diamonds with three diamonds in each row.

Figure 8 is a detailed drawing, showing how these diamonds are positioned in the matrix. The angle of the blade permits the diamonds to contact the wheel at right angles to its axis. Three diamonds contact the wheel simultaneously when the wheel is being dressed. The special matrix alloy securely bonds the diamonds in position, allowing the diamonds to be completely consumed in the tool. By overlapping the rows of diamonds, a new set of diamonds is being exposed and readied for dressing as the preceding group is being used up. Even though the matrix possesses this unusual quality for holding the diamond in position, it can be ground away, exposing new layers of diamonds, without glazing the grinding wheel.

For the **finish** grinding, a 60 grain wheel is used, but of "N" grade hardness. .020″ material is removed in finishing and a fine finish of 15-18 microinches is maintained.

Dressing Tool for Finishing

In the finishing, a **different** dressing tool was recommended than used in plunge grinding. Figure 9 is a picture of the blade-type tool used in finish grinding. This tool has several diamonds, in a single layer, covering the face of the tool but all making simultaneous contact with the grinding wheel. They can be completely consumed before replacement is necessary.

Here again, it is the presentation of a number of relatively small, but sharp, diamond edges which produce the superior grain fracturing action rather than a larger, single-point diamond tool. • • •

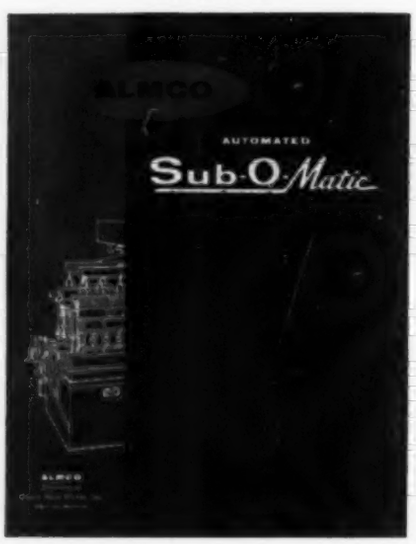
Available Literature

Catalogs and Bulletins Available from Manufacturers

For copies of the literature in which you have an interest use the postage-paid postcard. Merely circle the identifying number and mail the postcard.

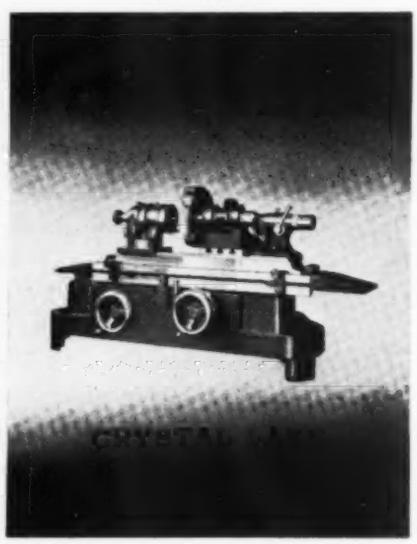
1. Barrel Finishing. Almco Div. of Queen Stove Works, Inc., Dept. GF, Albert Lea, Minn., has literature available describing and illustrating their automated Sub-O-Matic submerged-type barrel finishing systems, for high production descaling, deburring, grinding and burnishing. In this catalog you will find a detailed description of the Sub-O-Matic systems, what they are, how they work, and what they can accomplish for you.

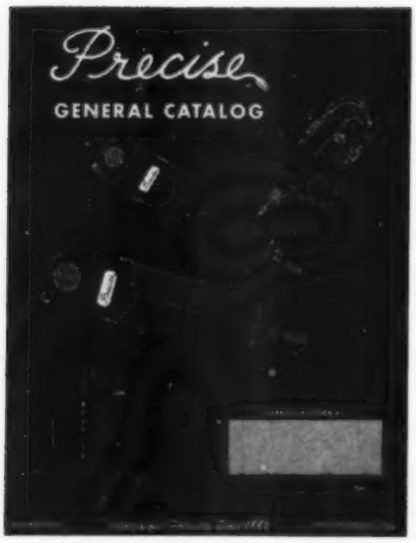
(see Number 1.)



2. Bench Grinders. Literature available from Crystal Lake Grinders, Dept. RG, Crystal Lake, Ill., describes and illustrates their line of universal, semi-universal, and plain precision bench grinders. These grinders are said to grind on dead centers from .000030″ to .000005″ in roundness being accomplished by the highly developed double taper bearing design having one bearing for radial and thrust load. Specifications are given.

(see Number 2.)





(see Number 3.)

3. Portable Electric Tools. Catalog FGH-2, available from Precise Products Corp., Dept. FF, Racine, Wis., describes and illustrates grinder millers; power quills; tools in steel tool chests; milling machines and accessories; H.S. drill presses; vari speed lathes; commutator mills; accessories for quills; machine tool mounts; filtration units; electric speed controls; application pictures and a price list.

4. Tool and Cutter Grinder. Bulletin 125, describing the new No. 12A tool and cutter grinder is now available from Covel Mfg. Co., Dept. GF, Benton Harbor, Mich. The 12A is equipped with a Pope 1 hp direct motor driven tilting swivel spindle. Clearance angles can be readily and easily determined with the aid of the scale; also quick acting clamps and gear adjustment are provided.

5. Gage Units. Catalog No. 8, describing and illustrating standard gage units for process and design engineering is available from A. G. Davis Gage & Engineering Co., Dept. RG, 21435 Dequindre Rd., Hazel Park, Mich. Catalog features standard gage units; standard indicator depth gages; standard flush pin gage blanks; internal groove diameter gages; and special gages, along with a complete price list.

(see Number 4.)

6. Grinding Fixture. The Harig Grind-All fixture, for higher accuracy, greater range and maximum speed in grinding perforators, is featured in literature available from Harig Mfg. Corp., Dept. GF, 5751 W. Howard St., Chicago 31, Ill. Designed to meet the need for a faster and more versatile perforator grinding attachment, the Grind-All permits grinding of irregular shapes concentric with shank within ±.0002.

(see Number 6.)

7. Diamond Wheels. Ace Abrasive Laboratories, Dept. FG, 35 Roselle St., Mineola, N.Y., has a new catalog available describing their Star Dust diamond wheels and hones. Also included in the catalog are diamond compounds,

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which are color identified for each grade.

8. Electrolytic Shaping. Anocut Engineering Co., Dept. FF, 631 W. Washington St., Chicago 6, Ill., has a new brochure available describing the Electrolytic shaping method for hard-to-grind materials. Anocut electrolytic grinding is a cold process and uses low pressures against the work, so there are no problems of work hardening or spot-annealing even on titanium or hardened alloy steels.

9. Electronic Formulation. Bay State Abrasive Products Co., Dept. GF, Westboro, Mass., has literature available describing their Electronic Formulation process. The name means just what it says—the precision of electronics applied to the calculation of manufacturing formulas for Bay State grinding wheels, through the use of modern electronic computers.

10. Automatic Sizing, for the constant, high production rates needed in coordinating production lines, is described in literature available from Bryant Chucking Grinder Co., Dept. GG, Clinton St., Springfield, Vt. Automatic sizing is essential on machines which are integrated into automated production lines. It minimizes the need for operator attention and helps maintain high production.

11. Portable Air Tools. Buckeye Tools Corp., Dept. GR, P. O. Box 966, Dayton 1, O., has literature available containing condensed information on their angle grinders and sanders; mini-grinders; impact wrenches; torque control units; ⅛" capacity nibblers; along with complete design and construction features.

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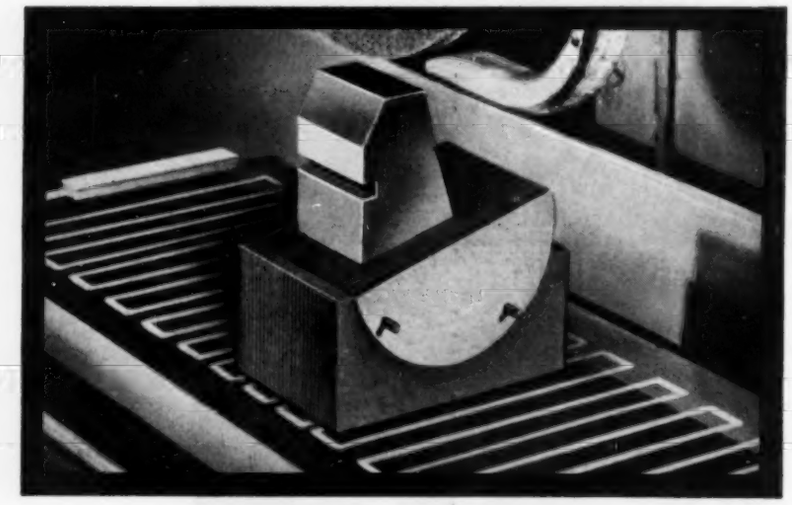

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12. Surface Finish. The Brush Surfindicator for measuring surface roughness is described in literature available from Brush Electronics Co., Dept. FF, 3405 Perkins Ave., Cleveland 14, O. With this production inspection tool you can make surface roughness measurements on the production line. The operator guides the pickup over the piece to be inspected, and reads surface in microinches on the meter.

13. Surface Grinders. Boyar-Schultz Corp., Dept. G, 2000 S. 25th Ave., Broadview, Ill., has literature describing and illustrating their 6 x 18 hydraulic and hand feed surface grinders. This machine is designed and built for tool room as well as for production use. Both hand feed and hydraulic models offer greater capacity, greater vertical height and better performance than ever before.

14. Air Operated Chucks. Crodian & Company, Dept. FG, 4897 Kessler Blvd., East Drive, Indianapolis 20, Ind., has literature available featuring their line of Stace precision air operated chucks. Ideal for lathes, borematics, profilers, internal and external grinders, mills, etc., the new Stace is guaranteed to hold concentricity to .0005—and many operators report no difficulty in working to .0002, with increased speed and fewer rejects.

15. Grinding Attachment. Cleveland Grinding Machine Co., Dept. FF, 1643 Eddy Rd., Cleveland 12, O., has literature describing their cylindrical and index grinding attachment that will convert your optical visual grinder to a cylindrical grinder in seconds. Attachments, applications and specifications are included.

16. Diamond Dressers. The complete line of diamond dressers is included in literature available from Arthur A. Crafts Co., Inc., Dept. G, 603 Newbury St., Kenmore Sq., Boston 15, Mass. Information is included concerning their diamond resetting service, diamond dust, wheels and tools, gages and wear-parts.

17. Optical Flats. Lapmaster Monochromatic light and optical flats for measuring flatness are featured in literature available from Crane Packing Co., Dept. FF, Lapmaster Div., 6400 Oakton St., Morton Grove, Ill. Light band readings through an optical flat, using monochromatic light source, are said to represent the most accurate method of checking surface flatness.

18. Surface Grinder. Literature is available from Columbia International Corp., Machine Tool Importers, Dept.

GF, 10-35 44th Drive, Long Island City 1, N.Y., describing and illustrating the ELB surface grinding machines. These grinders are made by a company in Western Germany, who specialize in surface grinders and who base the design of the machines on many years of experience.

19. Chuck Control. A new brochure announced by the DoAll Co., Dept. FF, Des Plaines, Ill., discusses their Selectrons for effortless and automatic control of magnetic chucks. Brochure gives details concerning the method of obtaining dc power from the rectifier and the principle involved in the infinitely variable control of holding power and the automatic demagnetization of chuck and work.

20. Grinding Wheels. A bulletin on grinding wheels for use on tools and cutters has been prepared by Electro Refractories & Abrasives Corp., Dept. GR, 344 Delaware Ave., Buffalo, N.Y. Vitrified and resinoid bonded grinding wheel specifications are listed for tool room applications. Bulletin includes information on resin bonded wheels as used to grind tungsten carbide and high speed steel cutters.

21. Belt Grinder. The Engelberg Huller Co., Inc., Dept. G, Syracuse, N.Y., has literature available describing and illustrating their model AG4 wet-dry belt grinder. It is a low-priced unit with a 4″x54″ abrasive belt running over a hard surfaced platen. An adjustable housing makes possible both vertical and horizontal use. It is basically a dry machine, but being fully enclosed, it may also be used for wet grinding.

22. Electro-Autosizing Machine Div., Industrial Gauges Corp., Dept. RG, West Englewood, N.J., has literature available describing their process of automatic and precise control of size during a work cycle by making the size of the workpiece itself control or stop the process. Accuracies of .00004″ are said to be repeated over and over, and are guaranteed for the operating lifetime of the machine.

23. Horizontal Comparator. Federal Products Corp., Dept. FF, 1144 Eddy St., Providence 1, R.I., has literature available describing their horizontal Master Comparator and their Model 130 comparator. An operator, observing common-sense precautions such as maintaining constant temperature, cleanliness and following correct operating procedure, will obtain repeat readings and detect variations equal to or plus one millionth of an inch with the Master Comparator.

24. Surface Grinder. The Astra Type H24, 10″x24″ hydraulic surface grinding machine is described and illustrated in literature available from Graham Machine Tool Co., Dept. GG, 19 Cleveland Place, New York 12, N.Y. This machine is medium-sized, quick-working and powerful with a greater grinding width and fully hydraulic table movement. Advanced design features are given along with complete specifications.

25. Visible Grinding. A new grinding method which permits the operator to see right through the grinding wheel is described in a new brochure issued by the Carl Hirschmann Co., Inc., Dept. GF, 30 Park Ave., Manhasset, N.Y. This method utilizes a specially designed unbreakable wheel, which when rotated horizontally at 3,600 rpm, creates a stroboscopic effect making the wheel, in effect, transparent.

26. Chucks. Literature is available from Horton Chuck, Dept. GR, Windsor Locks, Conn., describing and illustrating their complete line of independent chucks; scroll universal chucks, scroll combination chucks, two-jaw lathe chucks, face plate, and boring mill jaws.

27. Wheel Dressers. Hoglund hydraulic automatic dressers for centerless grinders are featured in literature available from Hoglund Engineering & Mfg. Co., Dept. G, 343 Snyder Ave., Berkeley Heights, N.J. Dresser features fast, accurate automatic contour wheel dressing with tenths accuracy on complex contours over the whole width of the wheel. Any desired contour that can be entered with a diamond can be dressed into the grinding wheel with a continuous, uninterrupted cut across the wheel.

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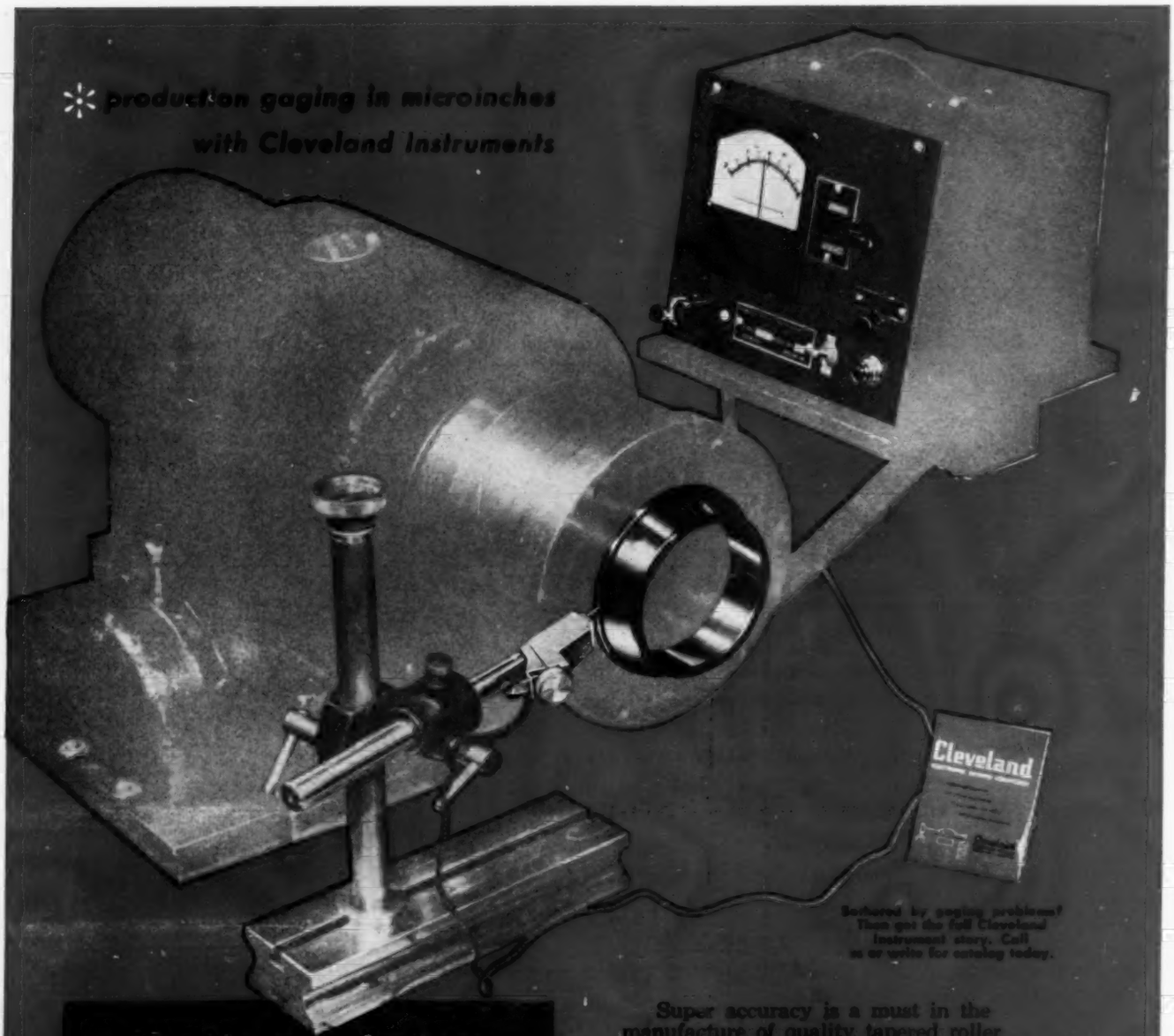

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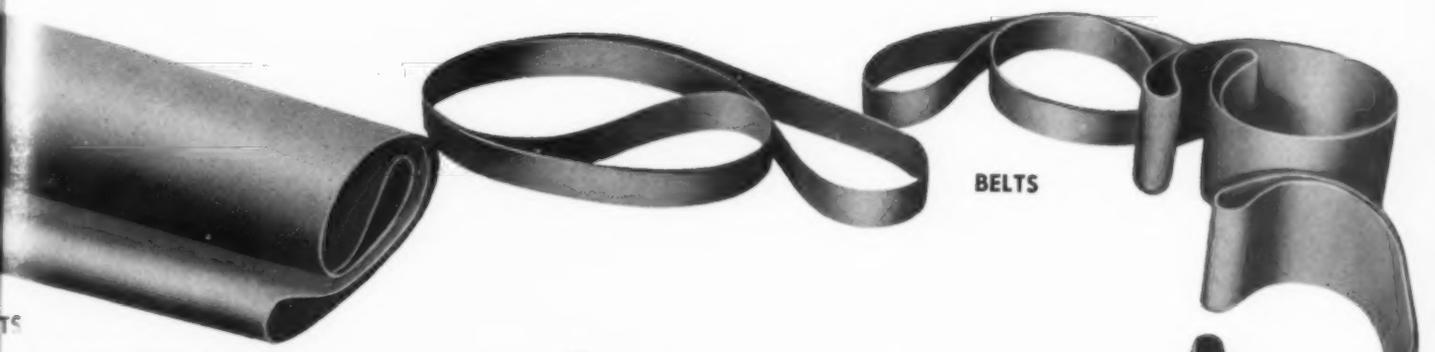

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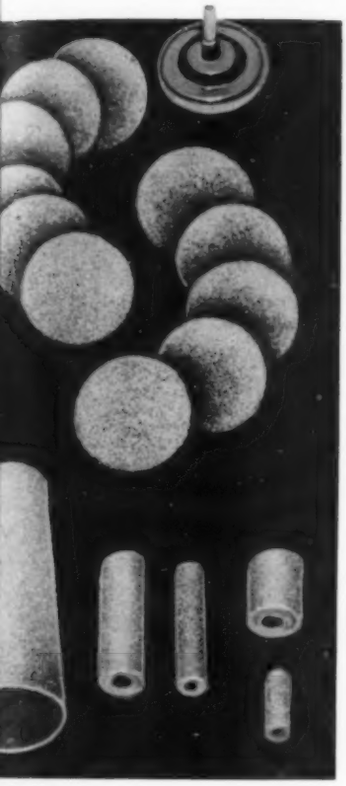

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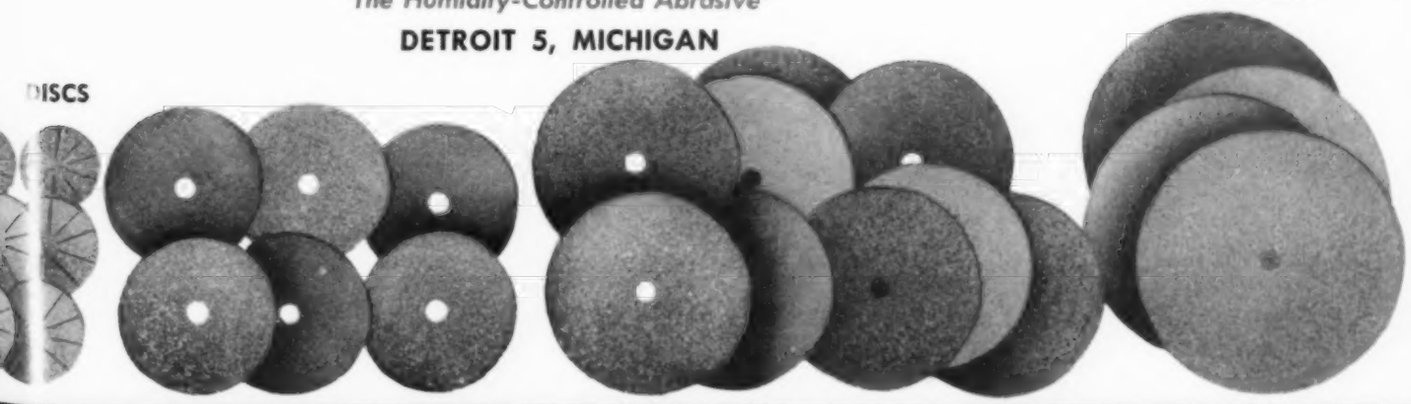

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Shop Hints and Short Cuts

Dressing an Angle on a Surface Grinder

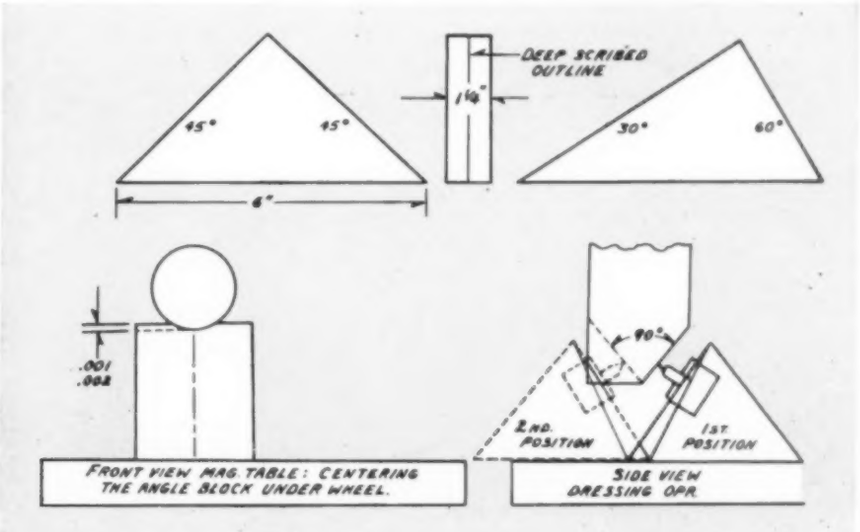
By **Carl J. Raeder**

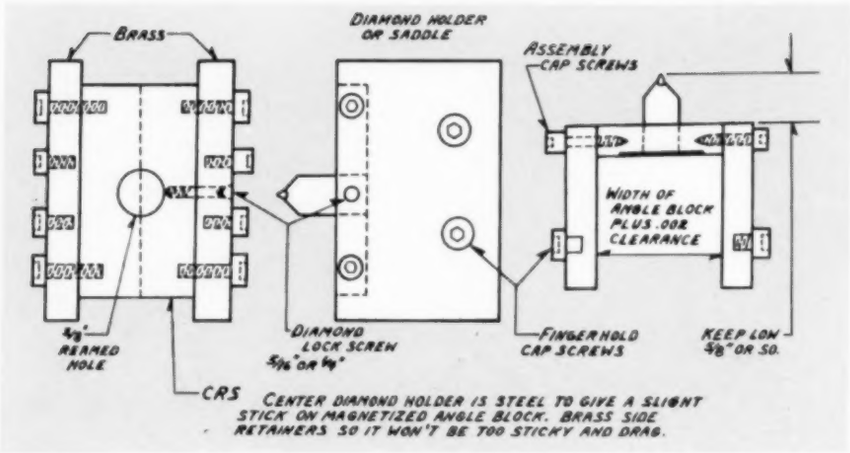
Dressing an angle on a surface grinder is a tedious and time consuming operation. Not all surface grinders have a built in angle dresser. There are adjustable angle tools on the market but the angle wanted is generally not the angle the tool was last set for and it takes time to reset it with a protractor accurately. Then, again, the diamond point must be set directly under the center of the wheel to get an accurate angle.

Using the angle blocks illustrated it is simple to repeat dress for any angle the block is cut for and to locate the diamond under the center of the wheel accurately. Diamond is of the centrally mounted type.

The two pieces, one with 45° on each side and the other with 30° and 60° are accurately ground, and to the same thickness from 1¼" CRS stock. They are laid on their sides and with a rigid scriber on a heavy planer gage a heavy center line is drawn on each slope deeply in the exact center.

Most magnetic tables are indicated on the front when bolted on machine. To use these blocks place with side square to front using a square and throw on magnet. At the apex of the angles take a light clean up grind, least possible. This narrow face is layout blued and placed as centrally as possible visually under the middle of the wheel which is dropped .001 or .002 and the table run in away from the operator. A fine contour mark will appear and should be equally distributed over the scribed center line. If not equal, shift table, reblue and try again. One or two tries brings the




BRASS
DIAMOND HOLDER OR SADDLE
ASSEMBLY CAP SCREWS
WIDTH OF ANGLE BLOCK PLUS .002 CLEARANCE
DIAMOND LOCK SCREW 5/16" OR 1/4"
FINGER HOLD CAP SCREWS
KEEP LOW 3/8" OR SO.
1/4" REAMED HOLE
CRS
CENTER DIAMOND HOLDER IS STEEL TO GIVE A SLIGHT STICK ON MAGNETIZED ANGLE BLOCK. BRASS SIDE RETAINERS SO IT WON'T BE TOO STICKY AND DRAG.

scribed center line in the middle of the wheel mark. The table is not moved again left or right.

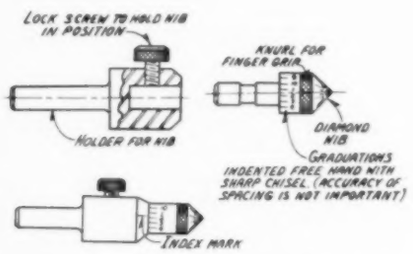
For dressing, the wheel is raised and the saddle with the diamond is placed on the slope for sliding up and down manually, using the side screws for finger grips. Use uppermost range of slope for visibility. Preferably the wheel was rough dressed previously by hand tool. The wheel is lowered and saddle slid up and down, repeating until a good bevel is obtained. Care in making the last passes will assure a good even bevel free of ridges, using light cuts and sliding surfaces free of transient grit.

When dressing 45° on both sides the wheel is raised, the table run in enough to accommodate the diamond holder and the operation repeated. This time the fingers are near the wheel, one hand on each side of the angle and care should be taken of the knuckles. • •

Rotatable Diamond Nib for Wheel Truing

By **H. J. Gerber**

It is always desirable to change the cutting position of a wheel truing diamond at frequent intervals. This is best done in some systematic manner in order to get maximum service from the diamond. There are on the market a number of devices which will rotate the diamond mechanically but they are rather expensive. The small shop may find that the following method can be effectively used.


LOCK SCREW TO HOLD NIB IN POSITION
KNURL FOR FINGER GRIP
DIAMOND NIB
HOLDER FOR NIB
GRADUATIONS INDENTED FREE HAND WITH SHARP CHISEL (ACCURACY OF SPACING IS NOT IMPORTANT)
INDEX MARK

The standard diamond nib can be altered in such a manner that the operator can constantly be aware of the position in which the diamond was last set even though it may have been removed from the holder and used in another machine.

A knurled band is first machined around the nose of the nib to provide a finger grip. The nib is then freehand graduated into a number of more or less equally spaced divisions around its periphery. These divisions are then numbered with hand stamps. The graduations can be indented with a sharp chisel and there is no requirement for a precision job.

An adapter is then turned up and bored out to a free turning fit on the shank of the diamond nib. The nib is secured to this adapter and locked in each indexed position by a thumb screw which seats into a neck machined in the diamond shank. This adapter should be left permanently secured to the truing support in case the diamond is frequently removed to use elsewhere.

This graduated nib can now be rotated in an orderly manner in order to most effectively distribute the wear on the diamond. • •

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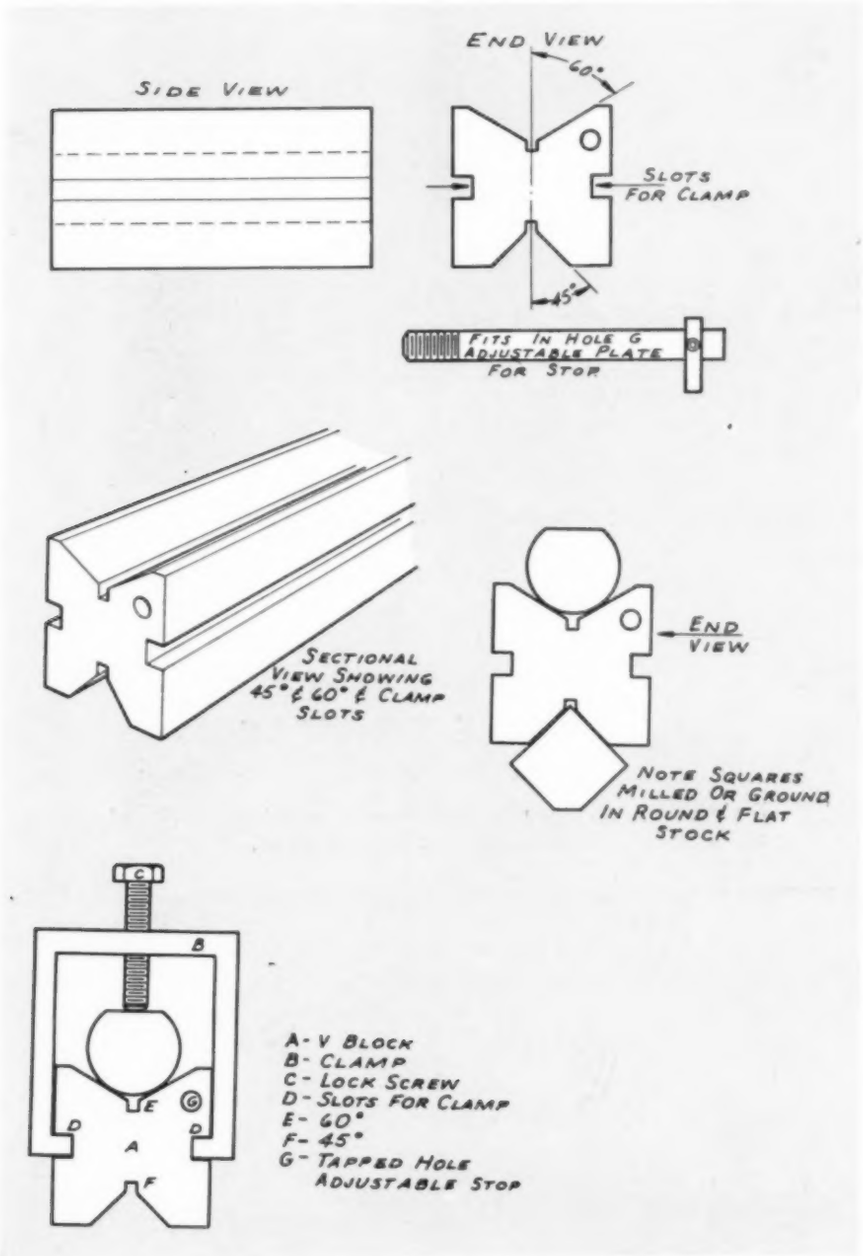
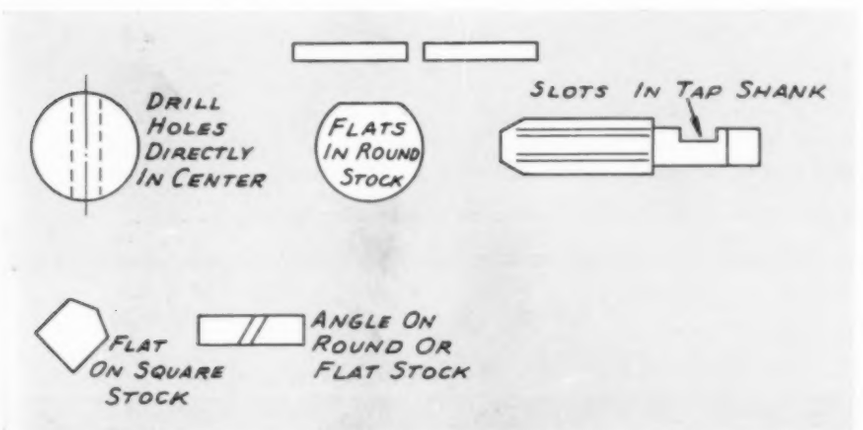
Special Holder for Round Stock, Square or Hex



This special holder for round stock, square stock or hex can be used to grind flats on round stock, for grooves, for shoulders, or for cut off operations. It is also handy for drilling a hole directly through the center of round stock, and for holding taps to slot shank for special holders.

It is especially useful for a job of several pieces when stop rod is used to make all pieces alike. The plate on the stop rod is adjustable. Clamp slides in slots in any position on block.

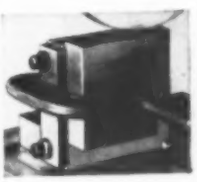
It can be used in a grinder with magnetic chuck, on a drill press on a table, on a miller with vise or shaper, or in a vise. The clamp can be reversed using 45° or 60°. • •



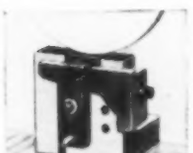
"I ask him, can he grind profiles, and this is what happens!"

LASSY MASTER V-BLOCK ANGLE PLATES

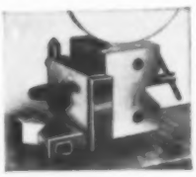
This Master V-Block Angle Plate is an improved new design. Saves hours of setup time. Assures precise work accuracy. Requires less skill.



Side Gage automatically squares work precisely and without removing angle plate from chuck. Repetitive accuracy maintained.



Adjustable parallel holds the smallest work for position and clamping with ease and accuracy.



LASSY MASTER Angle Plate provides a master setup for regrinding of worn or inaccurate Angle Plates.

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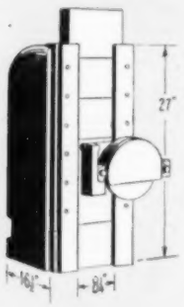
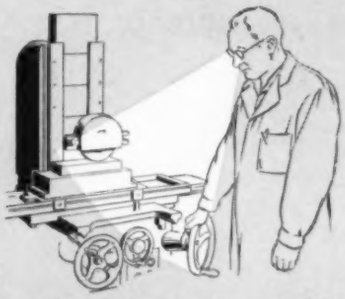


RIGID VERTICAL SLIDE

Grinding wheel and head are supported by the rigid vertical slide which is 16½" in depth. Length of vertical ways is 27". Distance between vertical ways is 8¼".



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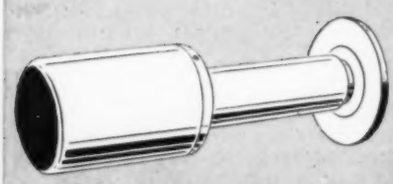

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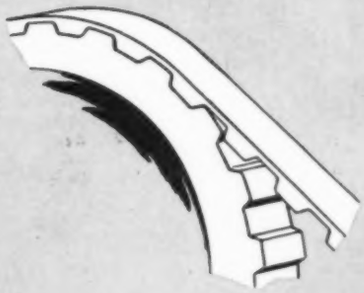

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Special Unit Solves Difficult, Costly Grinding Problem

• Jacobs Manufacturing Co., manufacturers of Jacobs Chucks, Hartford, Conn., has solved the difficult costly job of grinding the open jaws of their chucks, according to a report from A. E. Englund, vice-president of manufacturing. In the report, Englund states that they have increased production, reduced costly spindle replacement, and improved the grinding finish on the I.D. of their plain bearing key-type drill chucks. All this was accomplished by the use of Dumore Series 5 tool post grinder units.

In the past, bronze bearings and solid spindles made of drill rod were used for this grinding operation. Because the open jaws of the chuck necessitated what is known as an interrupted cut in grinding, as opposed to a continuous cut, these inadequate spindles lasted only three or four hours at most—and often broke down in minutes. An interrupted grinding cut transmits thousands of minute blows to the grinding wheel occasioned by the space between the jaw surfaces of the chuck. This hammering action is tough on the wheel and bearings—they break down rapidly if not made to withstand this treatment. In those days, a large production of spindles had to be maintained in the tool room to keep pace with those worn out in the grinding process. This was a costly, time consuming operation.

Being aware of the problem, The Dumore Co. of Racine, Wis., developed the Series 5 tool post grinder to help solve it. Jacobs Manufacturing installed such a unit on a Brown and Sharpe universal grinder several years ago with excellent results. These Dumore units convert the normally slow speed universal grinders into high speed internal grinders required for this difficult grinding operation.

Today, Jacobs Manufacturing uses several Dumore Series 5 grinders, plate mounted on universal grinders, and operate them 100 hours a week on two shifts. They operate at a speed of 40,000 rpm. In spite of the hammer-like blows on the grinding wheel—spindle bearings need replacement only three times a year. Besides the savings in spindle replacement and maintenance, these units produce a glass-like finish, thus eliminating additional finishing operations.

Englund further reports that the Dumore Series 5 grinders are exceptionally well suited for their work, because they provide sturdy power transmission, are made with a substantially solid spindle shaft, have self-oiling features, and have variable wheel speeds by changing pulley combinations. • •

The abbot and the Million Shiny Buckles

The *abbot* studied the small watchband buckles. Each was stamped from stainless steel with nicely defined, square corners, evenly spaced decorative ridges and precisely placed pinion holes.

The little man's visitor wore a worried frown. "How," he asked, "can we put a good, shiny finish on a million of 'em, quickly and economically?"

In less than a week, the *abbot* mailed his meticulously typed reply. "Your watchband needs burnishing," he wrote, "Try barrel burnishing with Abbott 3/16" Diagonals. You'll find they are shaped to do the job right. Besides, the Abbott Method is fast, economical and thorough."

Abbott Burnishing Materials make efficient and uniform contact on metal parts and castings of every size and shape. Made from selected carbon steels, they are Deep Hardened with a glass-hard, mirror-like finish. Combined with the Abbott Vertical Barrel, they make the *perfect* barrel finishing combination.

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Three Common Troubles in Grinding Between Centers

—and steps you can take to cure them.

by **Christopher H. Hill, Sr.**

Even with steady improvement in the manufacture of grinding wheels and grinding machines, trouble is sometimes encountered in obtaining a quality of finish or the degree of accuracy desired. These difficulties in cylindrical grinding between centers are usually of the nature classed as "chatters," "spirals," or "out of round." The commonest causes of these troubles and the rules for correcting them are given in this article.

Chatters are doubtless the most common surface defect encountered. They may result from one or more causes, but by far the largest percentage is due to one source—that of an out of balance grinding wheel.

It is not possible for grinding wheel manufacturers to produce grinding wheels that are all of an absolutely uniform density throughout. The slight unevenness in density is not sufficient to noticeably affect grinding action or the uniformity of wear, but in some instances the balance is affected.

This condition is corrected by counterbalancing, which serves the purpose of offsetting the heavy spot in the grinding wheel. It is quite obvious that if the heavy spot is located near the periphery of the grinding wheel, and the grinding wheel is counterbalanced to offset this condition, that when the wheel is worn an inch or two it will again be out of balance. When a new wheel is mounted it first should be trued, then taken intact with the flanges and put in balance, the unit then replaced and the wheel again trued. This is a quick and easy job, since most modern precision grinding machines come equipped with balancing type flanges. If any out of balance condition is noticed after about two inches of wheel wear the grinding wheel should be balanced again.

There are two types of balancing devices, rotary and knife edge. The advantages of the rotary type is that it does not have to be so delicately adjusted, the knife edge type having to be square and level. After the new wheel is trued it is removed intact with the flanges, the balancing weights removed, the wheel mounted on a special balancing arbor and the assembled unit placed on the balancing ways. The wheel will come to rest with the heavy side down. Then with a piece of chalk mark a straight vertical line at the top dead center of the wheel, replace the balancing weights and move them equally toward the chalk line until the wheel will not move in any position it is placed on the ways.

At the first sign of chatters the impulse of the uninitiated is to tighten the grinding wheel spindle bearings, jumping at the conclusion that the chatters are caused by loose bearings, for as a rule the importance of wheel balance is regarded lightly. Probably the bearings were in correct adjustment, and the necessary oil film clearance is reduced so that when the machine is started the grinding wheel spindle sticks. Wheel spindles and bearings on new machines have often been ruined by operators or maintenance men taking up the bearings because they did not warm up soon enough to suit them —and did so without regard for the class of work that the machine was turning out.

Experience has proven that there should be less trouble found in the grinding wheel spindle bearings than in any other part of the grinding machine. Manufacturer's recommendations should be followed closely as to the clearance between the grinding wheel spindle and the bearings, and as to the type of oil recommended. In many production shops where grinding wheels and grinding machines come under intelligent supervision it is not uncommon to see machines run from ten to twelve years without bearing trouble.

In instances where chatters continue after the wheel has been carefully balanced, a check of the general condition of the grinding machine will reveal the cause. A poor foundation or vibrations of the floor induced by other machinery in finishing work to a fine surface. A foundation that is bearing

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Courtesy—Studebaker-Packard Corporation

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How many facing operations in your shop can be done faster, better, and at lower cost on a Mattison High-Powered Duplex Surface Grinder?

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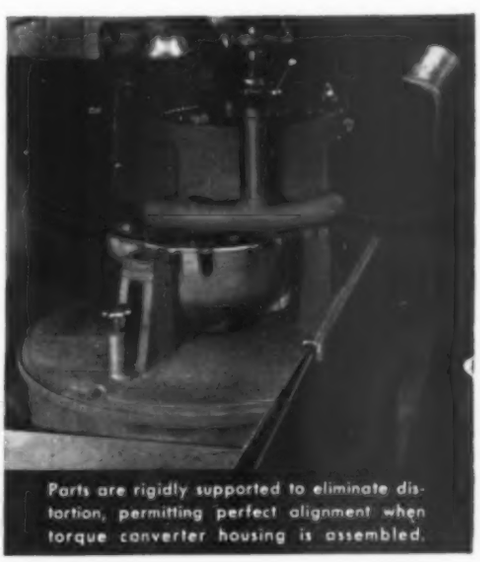
With two rotary tables, the Mattison "Duplex" eliminates downtime ordinarily required for cleaning and loading the table. Operator and machine are *both* more productive. This "all electric" machine is truly easy to operate . . . powered and rigidly built for heavy, multiple-pass grinding of small- or medium-size pieceparts. Why pay more for simple facing operations, or for grinding on a single-table machine, when the Mattison Duplex Rotary Surface Grinder can give you increased production, greater accuracy, and lower cost! Write for Bulletin No. 145.



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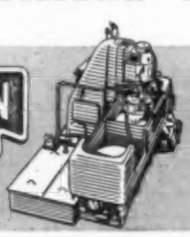

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Abrasive Grains, by Joseph J. Forrester.

What Is the Smallest Radius That Can be Dressed With a Wheel Dresser? By Henry F. Swenson.

Where and How You Can Use Abrasive Rolls, by Robert McAdams and James L. Erickson.

Also available are reprints of the Barrel Finishing Series by Morris S. Shipley and William A. Biebel for 35 cents a copy.

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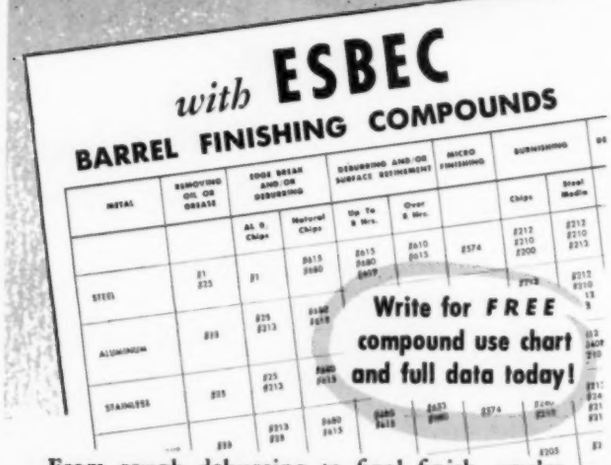

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Adaptor for straight bushed wheel — list price $4.75

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on the base at points other than those upon which the machine is designed to rest may be responsible for the defects.

Other factors that may be responsible for chatters, since they influence the cutting action of the grinding wheel are as follows: improper surface speed of the work being ground, use of a wheel of wrong grade, usually too hard. A loaded or improperly trued wheel, work centers and center holes that do not fit, and a failure to use a sufficient number of steadyrests on long work regardless how large the diameter of the piece being ground. Steadyrests applied incorrectly to the work have a tendency to cause chatters and/or grind the work out of round.

Spirals or Feed Lines

Spirals or feed lines are the effect of a number of different conditions, some caused by grinding methods, others traceable to the wheel or the condition of the machine itself. Under heavy cutting or where the grinding wheel is too hard or glazed, resulting in a high pressure of the wheel upon the work in an attempt to make it cut, feed lines are almost certain to be produced. A softer wheel adapted to the work, a change to faster work speed or the use of a sufficient number of steadyrests will remedy spirals if the machine itself is in correct condition. Correct truing of the grinding wheel is important, inasmuch as the cutting action is greatly affected by the condition of the wheel face. Experimenting with different truing speeds, the number of passes of the diamond over the wheel, and the depth of cut per pass may result in the improvement of its action. The manner of feeding the wheel into the work and the table traverse speed used are also factors worth considering when trying to eliminate spirals.

When the grinding wheel and grinding methods are correct for the work and feed lines are being produced the trouble probably lies in the machine. Errors in the alignment of the wheel spindle in relation to the table ways, or a bow in the table ways are the factors in the machine which cause heavy cutting by the wheel corner, making a spiral line on the work surface.

When the machine is at fault skillful operation will often reduce or even eliminate the appearance of feed lines. One method of accomplishing this is to withdraw the wheel from the work at the end of the traverse stroke where the condition is least pronounced and grinding the work in only one direction. To correct the trouble permanently it is necessary to realign the grinding wheel spindle with the table ways, as the case may be.

Spirals are produced when the grinding wheel spindle is not parallel with the directions of traverse of the work in all planes, since the slight play in the spindle bearings allowed for running clearance permits the wheel to float in a direction out-of-parallel with the motion of the table traverse. The end pressure in traversing tends to draw the wheel into or press it from the work thus causing it to cut unevenly. To overcome this condition it is necessary to scrape the bearings of the wheel slide and/or the table ways to correct their alignment.

In instances where feed lines are caused by inaccuracies in truing, since the face of the wheel is controlled by the truing operation, it follows that any misalignment of the wheel face with the direction of traverse of the work must be due to a weaving or swinging action of the table as it traverses. This action causes the wheel to be trued in one plane and the work to be traversed on a different plane, with the result that one edge of the grinding wheel cuts heavily producing spirals. It is possible to get this condition in truing since the table is traversed but a short distance in passing the diamond over the wheel generating a

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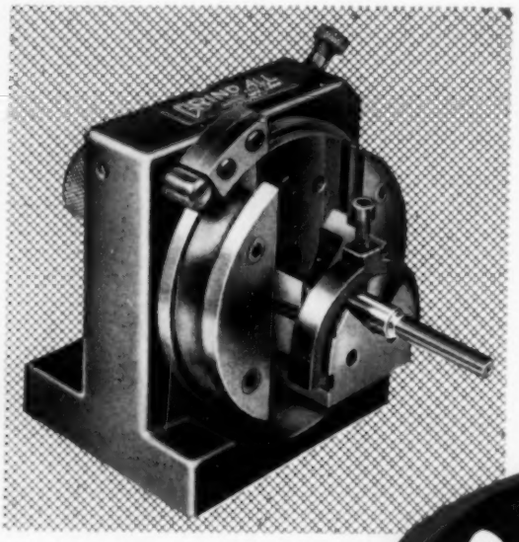
wheel face parallel to that section of the bed ways covered by this short stroke. Grinding a longer traverse stroke on a different section of the bed ways allows a motion in a slightly different plane if the bed isn't straight. To correct this trouble it is necessary to retrue the baseways so the table will traverse in a straight unchanging plane. This may be done sometimes on long machines by springing the base into its original position, as the wind in the surfaces is probably due to a sagging of the foundation allowing the base to deflect in some places. On short machines or those badly worn it may be necessary to rescrape the table ways to correct the trouble.

Out-of-Round Work

Work coming out-of-round is usually caused by one of four factors: centers or center holes which are not perfectly round, too scant a flow of grinding lubricant on the work to keep it at a uniform temperature and the grinding lubricant not being directed at the point of contact of the wheel with the work, the use of poor or improper steadyrests, or not enough steadyrests, or a grinding wheel too hard in cutting action. Centers should be ground frequently to a 60 degree angle and the points ground off slightly so that they will not bottom in the center hole of the work. Center holes in the work to be ground should be accurate and free from dirt and/or chips, for center holes that are not true reproduce out-of-round work. Work that has been hardened should have the center holes lapped if extremely accurate work is desired, as hardening warps the roundness of the center hole.

Most operators hate to use steadyrests, but their use on such long and heavy work such as locomotive piston rods, radial drill columns, automobile lift columns, etc. will not only increase production but are a preventive for out-of-round and chatters. The steadyrest shoe or bearing should be brought against the work without undue pressure, merely applying enough force to give the work a rigid support. The center line of the horizontal support should be in a plane with the centerline of the work being ground, but the vertical support should have a bearing beyond center. This gives the work the effect of resting in a saddle, and the vertical support in this position prevents the work from running out towards the grinding wheel and being ground out-of-round. Too hard a wheel will cause work to come out-of-round no matter how ideal all other conditions are. This is especially true in finish grinding crankshafts.

While many of the points mentioned above as possible causes of unsatisfactory finish or inaccuracies may seem trivial and beyond the likelihood of occasioning the troubles attributed to them, they will be found logical if it is realized just how minute are these defects in most cases. Chatters and spirals that are easily discernible may be so slight in their depth that sensitive measuring instruments fail to show the variation. Even out-of-round that would be considered sufficient for complaint is, in the majority of cases, an error of a small fraction of .0001 inch. The refinement of tolerances and finishes made possible by modern grinding wheels and grinding machines have made it possible to manufacture airplane engines, automobile engines and other mechanical machinery so that one hardly ever hears of the word failure any more.



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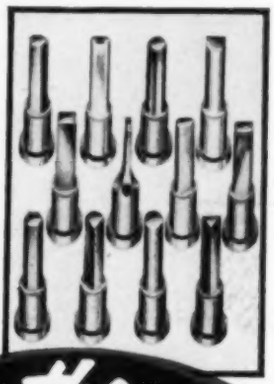

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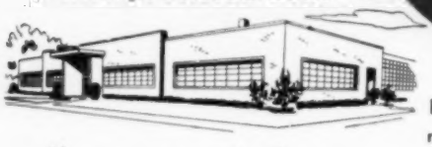

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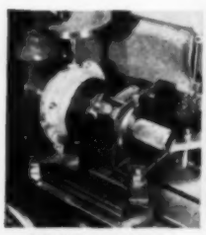

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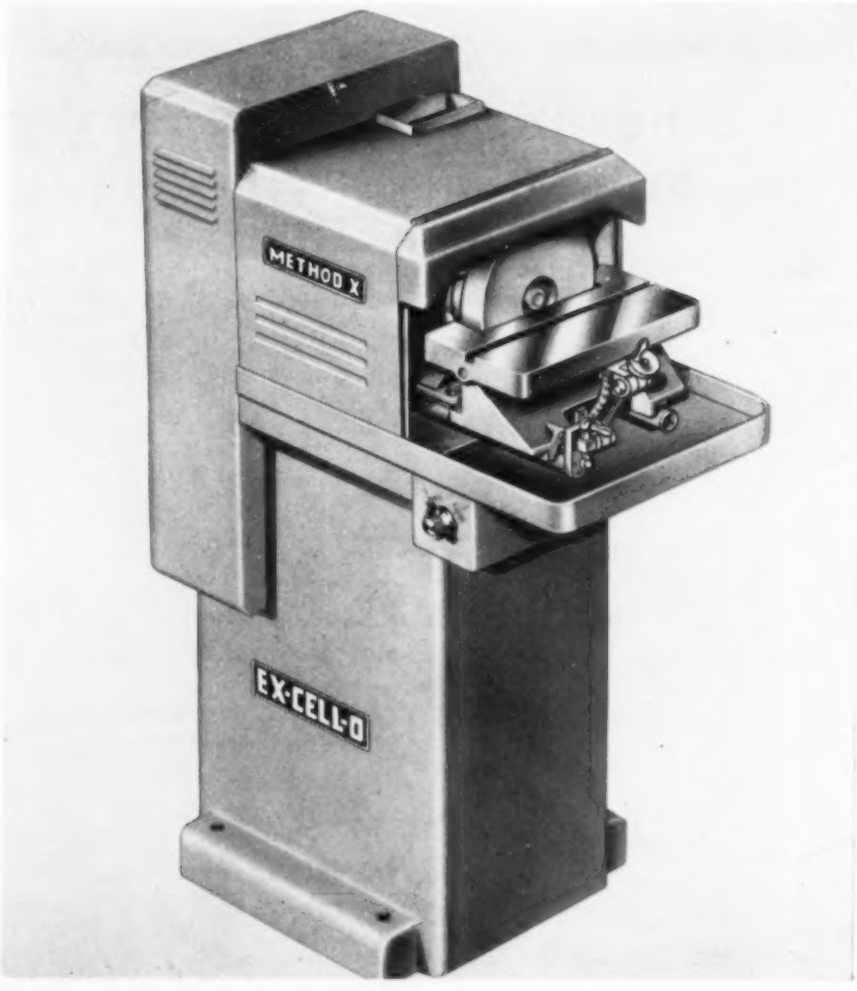
What's New in Equipment and Materials

Offhand Tool Sharpener for Sharpening and Modifying Cutting Tools by an Electro Spark Process

Firth Sterling Inc. has recently presented to industry the Method X Offhand Tool Sharpener, an electro spark process for sharpening and modifying cutting tools. Developed and perfected by the Method X Co., a subsidiary of Firth Sterling, this offhand tool sharpener removes both carbide and shank simultaneously. Metal is removed from the tool by an electric spark crossing the gap between a cast iron wheel, acting as the electrode, and the tool which is separated from the wheel by a semi-solid dielectric film. Because the film prevents contact between the wheel and tool, wheel wear is negligible, and damage to wheel or tool is impossible. The cost of the wheel is approximately $8.00.

The Method X Tool Sharpener elimi-



nates the need for diamond or any other abrasive grinding, effecting greatly reduced tool maintenance costs. Metal removal is accomplished, in most cases, in less time than with present conventional methods. Both roughing and finishing are performed on the same wheel eliminating the need for the two operations required by present conventional practice.

In field tests, it has been found that Method X sharpened tools give increased tool performance. This is explained by the fact that resistance to chip flow is greatly reduced, thereby lowering the operating temperature of the tool. Furthermore, thermal shock is not present when servicing tools.

The following are typical examples of performance reports from the field:

a. In the plant of a leading machine tool manufacturer, Firthite Grade TXH diamond ground tools were placed on a new J & L lathe, 16" capacity, 15 horsepower. The operation consisted of turning three diameters on a SAE 4140 steel forging; average depth of cut was ¼", feed .017" and 250 SFPM. After turning four pieces, the diamond ground tools were pulling slightly over 16 horsepower. These tools were removed. Method X sharpened tools of the same grade and style were put into operation with an indicator reading of slightly over 9 horsepower. After turning 44 complete pieces with an additional tool added to the setup to make a ½" by 45 degree chamfer, the horsepower indicator showed that 12 horsepower was being consumed. Chip flow was a great deal more uniform than that produced by the diamond ground tools and the cratering was 30% less.

b. The research department of a leading equipment manufacturer submitted a report on triangular and square carbide inserts. The inserts sharpened by Method X performed 100% superior, with respect to edge wear, on gray iron than those inserts which were conventionally ground. And the Method X sharpened inserts running on steel performed, in all cases as good, and in most cases better. The

inserts are still running.

c. In the plant of a leading manufacturer, E-8 single point tools sharpened by the Method X Tool Sharpener were placed on a Bullard vertical lathe at 260 SFPM, .037" feed per revolution and .010/.020 depth of cut in machining a cast iron flywheel. The operation was facing and plunging. Production resulting from the Method X sharpened tools was in excess of 85% higher than from those tools ground by diamond wheels. Conventionally ground tools produced 145 average number of pieces per grind and registered an average wear land of .022; whereas Method X sharpened tools increased average number of pieces per sharpening to 225 and the average wear land was only .014.

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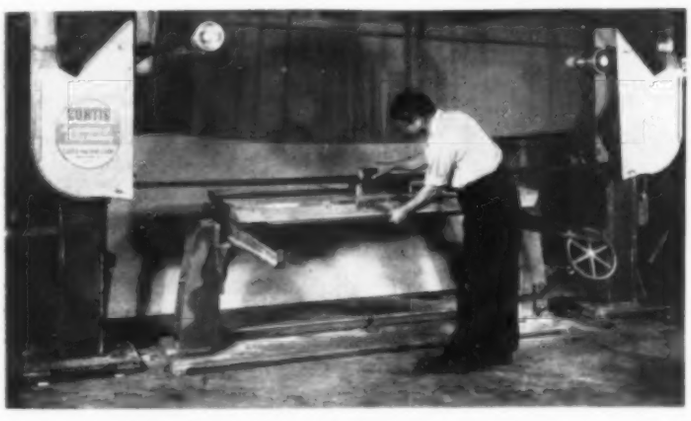

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Another advantage is the fact that, with this unit, blue print tools can be made from standard tools, because both steel and carbide are efficiently removed in one operation. This can effect substantial saving in inventories. Only standard size tools, best suited to individual modification requirements, need be stocked.

At the recent Production Engineering Show in Chicago and the American Society for Metals Show in Philadelphia, the Method X Tool Sharpener was displayed and demonstrated and was most enthusiastically received. Over 2,000 names, interested in further information on the sharpener, were registered. This is a gratifying indication of the acceptance of this new concept in tool servicing.

The Method X Tool Sharpener has prominent significance in the nation's economy. This new process averts the drain on a critical item—diamond bort. Thirty percent of the diamond bort in this country is used in sharpening cutting tools. The Method X Sharpener, with its cast iron wheel, requires none.

The Method X Tool Sharpener is being manufactured by the Ex-Cell-O Corporation of Detroit, Michigan under license granted by the Method X Company. Sales will be handled by both Firth Sterling and Ex-Cell-O. •

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Black Granite Surface Plates and Accessories

The DoAll Company of Des Plaines, Ill., is now manufacturing granite surface plates and granite accessories in addition to their extensive line of gage blocks and gaging instruments. These new products are being produced from "black" granite exclusively. According to tests conducted by the National Bureau of Standards, black granite (basalts and gabbros) was indicated to be stronger, denser and less absorptive than "normal" granites available in the United States.

Granite plate sizes marketed by DoAll range from small toolmakers' flats 8" x 12" to huge, one-piece layout tables 72" x 144". Larger table areas can be obtained by joining several granite tables with special stands, also marketed by DoAll. Large tables are coming into wide use for layout and form moulding work on large parts.

Accuracy Defined

A unique approach to the controversial subject of surface plate accuracy is provided in DoAll's practice of defining the rated accuracy by stating the tolerance for the over-all surface area of the plate. This gives meaning to the accuracy rating of the plate, makes it comprehensive and therefore of value to the user in conducting measurements. Up to now, most accuracy ratings have been given for each unit of area within the total plate area so that the over-all plane accuracy was vague.

Granite Accessories

Under the category of granite accessories, DoAll has made available black granite straight edges, parallels, chuck platforms and angle plates. These are intended for use either in checking steel and granite plates or for making setups to check dies, tools and other parts. •

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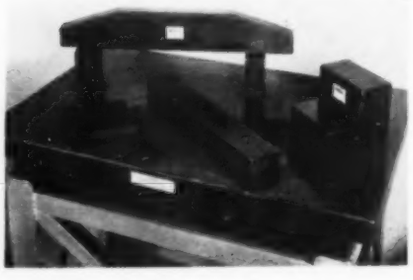

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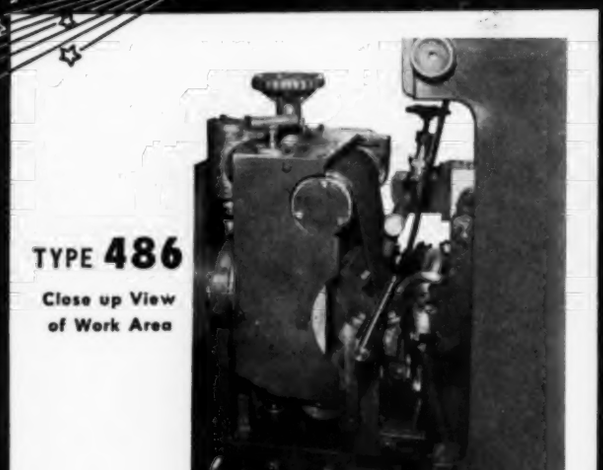

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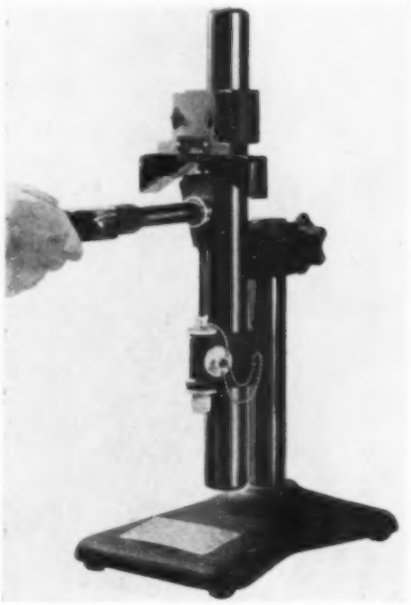
Setting Master for Dial Bore Gauges

An adjustable Setting Master for dial bore gages is offered by Standard Gage Co. Inc., Poughkeepsie, N. Y. as a substitution of this one instrument for a number of fixed master ring gages which would otherwise be required. This Master is set by means of gage blocks to any desired dimension between 1" and 12⅛" and thereafter serves for the initial setting or subsequent reference of a dial bore gage. The Master can be successively reset to a number of different dimensions within its range.



A combination of requirements is met by the swivelling column which locks in either of two positions. While setting the Master it is necessary to keep the weight of the gage blocks off the adjustable anvil and while setting or checking the dial bore gage the weight of the gage itself must be kept off its movable plunger and centralizers. Thus the Master is set with its adjustable anvil uppermost, that anvil is clamped in the set position, and then the column is rotated 180 degrees to bring the centralizing yoke on top.

When setting the Master to gage blocks proper pressure is assured by a ratchet drive similar to those used on micrometers. The setting of the bore gage is facilitated by a guide cap which prevents its lower end from slipping. Gages for sizes between ¼" and 1" can also be set to this Master although without the help of the "V" for centralizing or the guide cap for positioning. This operation requires a reasonable amount of skill but is quite easily done with the light weight sizes below one inch. •

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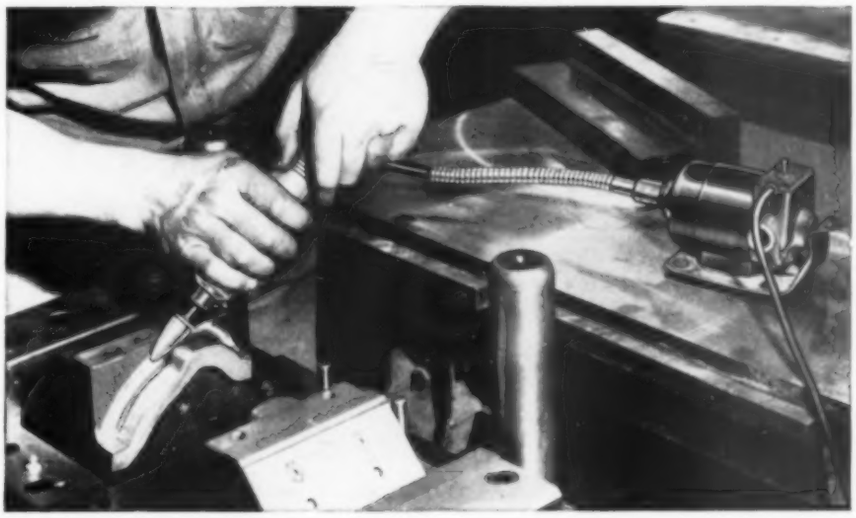
New! A cooler, smoother running, more flexible production hand tool!



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For continuous duty production grinding and finishing and for closest die work, the new Dumore Super-Flex offers new efficiency and ease of handling.

Manufactured to closest tolerances, the Super-Flex is extremely cool operating, and is vibration-free. Worker fatigue from using this tool is practically non-existent—even after day-long use.

And it's so flexible! The handpiece rotates freely on the shaft eliminating any chance of the shaft kinking, entangling, or hindering the operation in any way.

The Super-Flex takes all ¼" or ⅛" shank tools. For fast metal removal, the combination of Super-Flex with carbide burrs can't be beat. It has full ¼ hp, 22,000 rpm output for full-shaft grinding, filing and burring.

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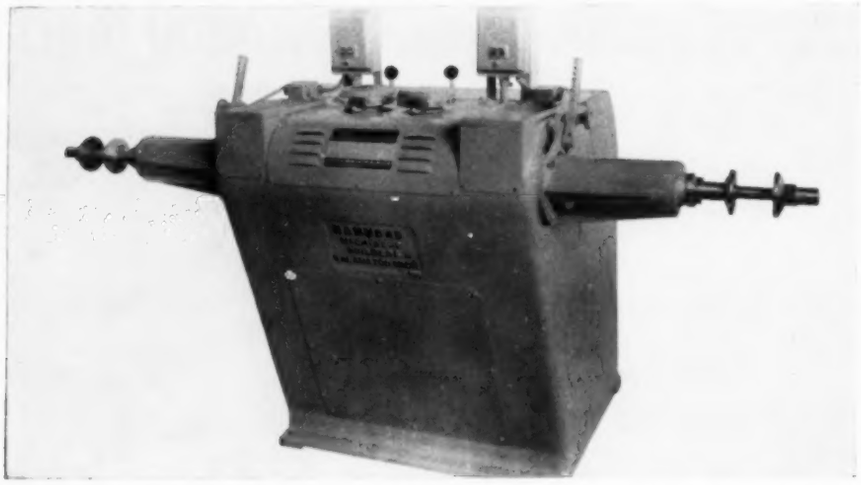

Responding to numerous requests from various industries for a two-spindle, variable speed buffing and polishing lathe with a wider swing, Hammond Machinery Builders, Inc., Dept. 1651, Kalamazoo, Mich., has announced the availability of their newly designed Model VRROW.

According to the manufacturers, this lathe has a swing of 20" from side of base to face of inner flange, instead of the usual 12" swing of conventional lathes. The two spindles on the new lathe operate independently, each having its own motor and variable speed control. This permits each operator to change wheels or vary speeds without interfering with, or causing down time to the other. Each operator has full 5, 7½ or 10 hp on each wheel. Spindle speeds can be changed instantly while lathe is running by turning the dials. •

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High-Speed Swivel Head Metal Cut-off Machine

A new low-priced cut-off machine, the Model M-35-A, has been developed by Stone Machinery Co., Inc., Manlius, N.Y., for faster, cleaner power-cutting of ferrous and non-ferrous materials at a rate of less than 4 seconds per square inch.

The M-35-A cut-off machine features an adjustable swivel head for angle cutting up to 45° in either direction, left or right. Abrasive wheels for ferrous cutting and steel saw blades for non-ferrous cutting are available in either 12 or 14" sizes.

Maximum ferrous capacity is 1½" solids, 2½" standard pipe, and 2½" structurals. Non-ferrous capacity is 2½" solids, 3" tubing and extrusions.

The new positive drive cut-off machine has a 1" arbor, and is powered by a 3½ hp geared-in-head induction type motor, 3450 rpm, geared to 3150 rpm wheel spindle speed. Work support height from floor to 24½" x27½" table top is 38½". Weighing 515 lbs., the compact Model M-35-A requires only 30" x 40" floor space. Machine equipment includes wrenches and one pair of 3¾" wheel flanges. •

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Here's power—SUSTAINED POWER—like you've never experienced before in an air grinder . . . power unexceeded by any other air grinder in the same price range . . . **maintains its high-speed efficiency under load!** Built with a lightweight, contoured, hand-fitting aluminum housing, the Haskins **haskAIR** Grinder handles easily, balances perfectly . . . excellent for the most precise grinding job. Complete kit includes: carrying case, adapter hose, mounted points, dressing stone and wrenches.

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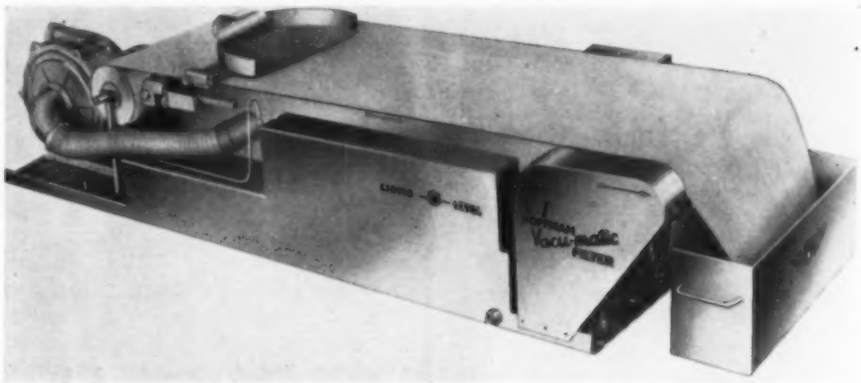
THESE BUSINESS REPLY CARDS ARE FOR YOUR CONVENIENCE AND TO SAVE YOUR TIME

New, Improved Vacu-Matic Filtration Unit



The Industrial Filtration Div. of the U.S. Hoffman Machinery Corp., 103 4th Ave., New York 3, N.Y., has announced the complete re-design of their Vacu-Matic filtration unit. This new and improved unit is now known as the Hoffman Vac-40 Vacumatic Filter.

Completely automatic and self-cleaning, the Vac-40 is designed for use on grinders, hones and other machine tools where continuous and effective filtration of coolants is desired. It employs vacuum rather than gravity and is capable of delivering extremely high flow rates in sustained operation.

Using a specially-fabricated paper as its filtration medium, it delivers dry sludge with no coolant carry-over, thus minimizing coolant loss. The newly re-designed unit is compactly constructed so that it will easily fit into the space normally required by a sump tank. The paper filter medium is supported by an endless fabric belt which in turn, is carried on a wire mesh belt which revolves continuously on a chain-sprocket drive. A large vacuum chamber is located directly beneath this belt, and the vacuum tends to hold the paper tightly against the supporting screen.

Dirty coolant flows by gravity from a baffled distributor on to the filter paper directly over the vacuum chamber. Coolant is uniformly distributed over the entire width of the paper surface. Owing to pressure differential created by the powerful vacuum, the coolant is filtered rapidly through the paper into the vacuum chamber. The clean coolant drains into the clean coolant sump, and is then delivered back to the machine tool by the supply pump. A liquid level sight glass is installed in the clean coolant sump so that the machine tool operator can instantly determine the coolant level.

Solid particles removed from the coolant are deposited on the paper, and when caked so thick that suction can no longer be effectively maintained through the belt, the belt is automatically indexed forward by a vacuum switch. This provides a new filter area, allowing continuous operation and preventing shut-down of the unit for cleaning. When the unit indexes, previously collected sludge and dirty paper are discharged into the unit's tote box.

Filter paper is available in 200 yd. rolls and has a long life expectancy. An example of this can be found in the use of a Vac-40 by a major producer of automotive parts in the mid-west. In use for a period of 3½ months connected to a grinder used for both rough and finish grinding, the unit has been processing an estimated 30 gallons of coolant per minute, 16 hours a day, five days a week, and has yet to use its first roll of paper.

The unit is also provided with an automatic overflow. Should there be a temporary loss of vacuum or clogging of the unit, the pump continues to deliver coolant to the work. Unfiltered coolant is thus by-passed back to the work, preventing damage to the machine tool, and subsequent down-time and production delays. •

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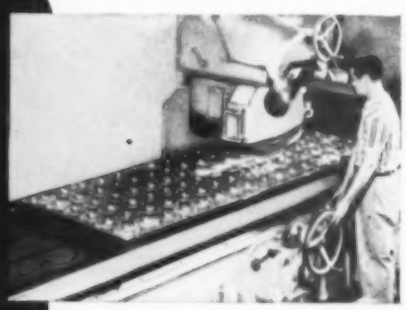
For Holding

SMALL

MEDIUM or

LARGE PARTS



Grinding a load of 102 gears.

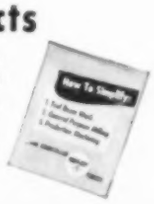
Use Sundstrand Magnetic Chucks

Here's another interesting application of magnetic holding applied to a surface grinder. The deep penetrating power of the Sundstrand magnetic chucks makes it possible to hold a great number of small parts or large castings. In all cases setup is simplified and clamping time is greatly reduced.
Whether you have tool room, production, or special holding problems, look into the possibilities of eliminating expensive clamping and increasing production with Sundstrand Magnetic Chucks.

Grinding four slide castings.

Get All the Facts

Write for complete information on these time saving magnetic chucks. Ask for bulletin 467M.



Grinding drill press frame

SUNDSTRAND MAGNETIC POWER-GRIP

SUNDSTRAND
Magnetic Products Co.
Division of Sundstrand Machine Tool Co.
1020-9th ST. • ROCKFORD, ILLINOIS

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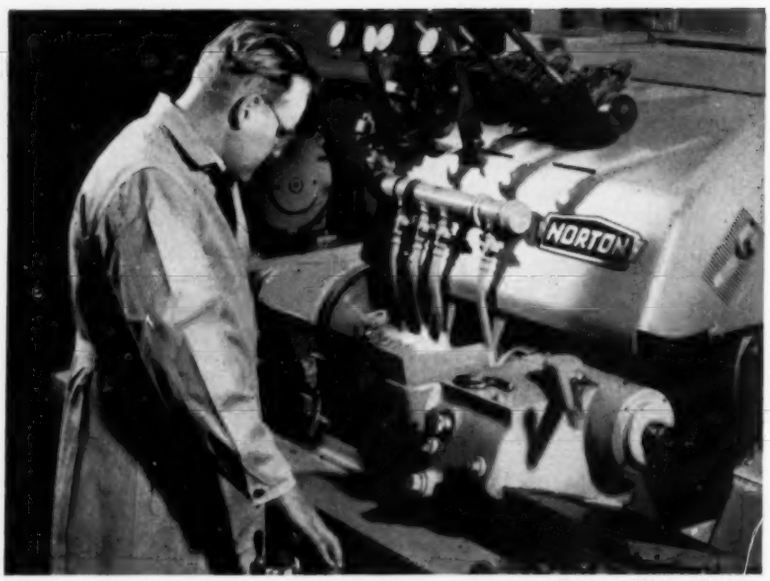
PRESTO!

an "Open Wheel" with "1500"



Courtesy of Norton Company

Grinding operations in a great many plants are impeded by slow settling of chips . . . clogged coolant lines . . . excessive foam . . . all of which result in costly loss of efficient grinding action. *Worse yet,* "loaded" wheels make it impossible to get clean stock removal and the desired finish.

Even the finest grinding machines are only partially efficient under conditions such as these. Seasoned operators know what is needed — a change to the proper coolant!

Shop superintendents will tell you the answer: Use *W & B Concentrate* **"1500"** Results are astounding and immediate. **Chips settle immediately; coolant lines run free; foaming stops as if by magic. Wheels are "open" and the result is keener grinding action and cleaner stock removal.** Case histories* of many such "1500" successes are at hand in the W & B files.

To know more about the advantages of using "1500", write for W & B Catalog Page A-3; or call in the W & B Industrial Lubricants Expert. Take advantage of W & B 's 67 years of experience and know-how!

(*Names on request.)

W+B INDUSTRIAL LUBRICANTS

THE WHITE+BAGLEY CO.

WORCESTER, MASS. • DETROIT, MICH.

Originators of Grinding Lubricants

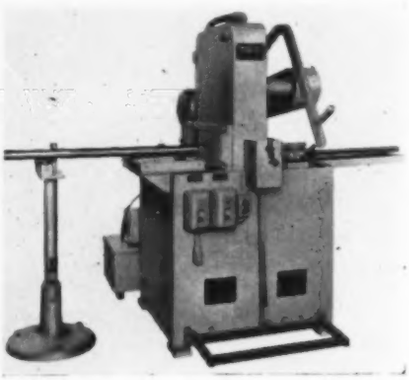
Circle No. 243 on postpaid card

Wet Abrasive Cutting Machine

Almost any metal and other hard materials can be cut economically with this heavy-duty, high-speed abrasive cutting unit, according to its manufacturer, Campbell Machine Division, American Chain & Cable Co., Inc., Bridgeport 2, Conn.

Designated the Model 64 Oscillating Wet Abrasive Cutamatic, this rugged machine permits the cutting of medium-sized bar stock, etc., through its oscillating cutting principle. It makes possible the highest quality cutting of large cross-sections and many shapes.

Equipped with a large diameter Allison abrasive cutting wheel, up to 18 in. for certain applications, it will sever sheets, angles, channels, pipes, tubes and solids of practically all analyses. This includes hardened or annealed steel, brass, bronze, monel metal, aluminum, magnesium, tungsten, tantalum carbide, beryllium, titanium, ceramics, phenolic plastics, glass, etc.



Designed for use in metal working shops, factories, mills, foundries and maintenance shops, it is capable of cutting 3 in. diameter solids, 4 in. diameter tubing and 6 in. by 1 in. steel plate at 90 deg. to axis at speeds of approximately 4 seconds per square inch of material being cut. Its swivel type vise, which is foot treadle operated, can be rotated from 0 to 45 deg. with a maximum opening for 45 deg. cuts of 4 in.

The Cutamatic is an oscillating type machine in which the wheel and work are fed manually and its work clamps are operated by a foot treadle. Through its oscillating motion, the amount of abrasive wheel contact is materially reduced as cutting is performed with a minimum of wheel pressure.

The unit's pedestal is fabricated of welded steel and is constructed with a self-draining coolant collector. Its spindle, of forged alloy steel, has been heat-treated, precision ground and is dynamically balanced. Each end of the spindle housing has labyrinth sealed type caps to retain lubricant and prevent entrance of dirt. The spindle pulley is end-clamped and keyed to the spindle, assuring a tight and permanent assembly.

The oscillating unit is power driven by a 1/3 hp geared-head motor. An oscillating link carries the swing arm on one end, while the other end is mounted on a heavy bracket which is attached to the base plate. Both ends are mounted on self-lubricating bushings.

The wheel guard is permanently fixed to the bed of the machine and entirely encloses the wheel except for openings on either side for entry of work. A hinged type door provides quick access to the abrasive wheel.

In the coolant system, a large, wheel mounted separate coolant tank, permits easy removal for chip cleaning. Separate compartments settle out the sludge and keep the coolant cool. The coolant is pumped at the rate of 30 gpm through a hose into the top of the wheel guard. Baffle plates, between which the abrasive wheel runs, assure thorough and equal wetting of both sides of the abrasive wheel and guidance of the coolant directly to the critical area of cutting.

The Cutamatic is furnished with a 10 hp., totally enclosed, fan-cooled motor to drive the abrasive cutting wheel. Drive from the motor to the spindle is through multiple V belts. Extremely rugged, the unit measures 68 in. front to back, 62 in. left to right and 65½ in. high. Net weight with electrical equipment is approximately 2000 lb. •

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CLIPPER

PRECISION DIAMOND TOOLS

Industrial Diamonds
Thread Grinders
Turning Tools
Engraving Tools
Dressing Tools
Diamond Powder

Manufacturers of
DIAMOND TOOLS
and
WHEELS

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CLIPPER DIAMOND TOOL CO., INC.

345-E HUDSON ST. NEW YORK 14, N.Y.

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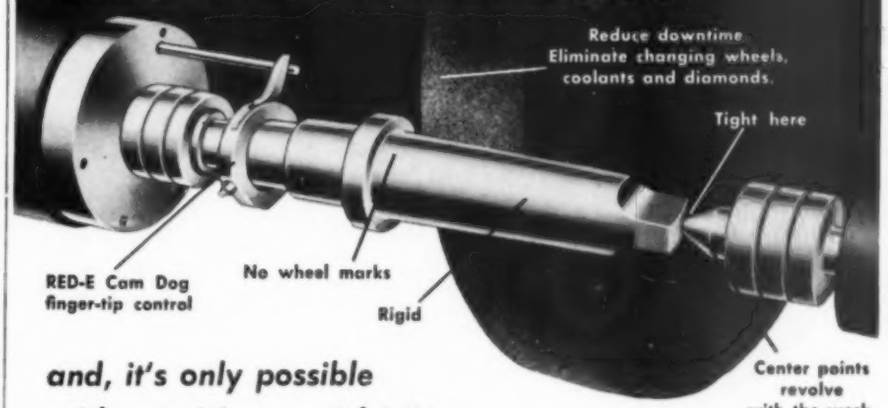
Accuracy: to less than 50 millionths —

MAN... THAT'S MICRO-FINISH!



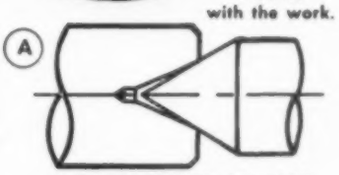
and, it's only possible with precision, anti-friction

RED-E GRINDER CENTERS

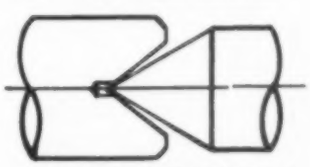
Chatter, wheel marks and out-of-roundness is caused by looseness in the center hole. The center and workpiece must be integral . . . rigid; the point in contact with the largest periphery of the centerhole, as illustrated in (a). Likewise, the bearing assembly must be able to provide great radial and thrust load capacities, with a minimum deflection under continuous operation.

If you're using anything but RED-E it's costing you money and you're not getting micro-finish!

Help yourself to super finishes. Read the new RED-E booklet "A New Concept In The Art of Grinding." Ask your Industrial Distributor for a copy today, or write direct.

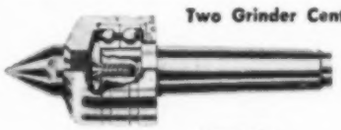


CORRECT CENTER CONTACT

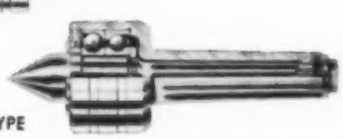


INCORRECT CENTER CONTACT

Two Grinder Center Types



SHANK TYPE



SPINDLE TYPE

Only RED-E GRINDER CENTERS are constructed to meet these requirements because:

1. Bearing assemblies are locked in, Duplex ABEC-7 spec, Precision, Preloaded, Angular Contact New Departure ball bearings.
2. Points are of High Speed Steel, ground 60 degrees, 30 minutes included angle.
3. Lubricated for life.
4. Labyrinth enclosure keeps out all coolants.
5. Guaranteed.

TAPERS AVAILABLE

	Morse	B&S	Jarno	Norton	Landis
SHANK	1 to 6	5 to 15	4 to 20	10 to 16	.8125, 1.335, 1.750
SPINDLE	2 to 7	7 to 18	6 to 20	10 to 24	.8125, 1.335, 1.750

Special heads, tapers, shanks and points made to order.

CENTER *Specialists Since* 1908

RED-E-TOOLS READY TOOL COMPANY

566 Iranistan Ave. • Bridgeport 5, Conn.

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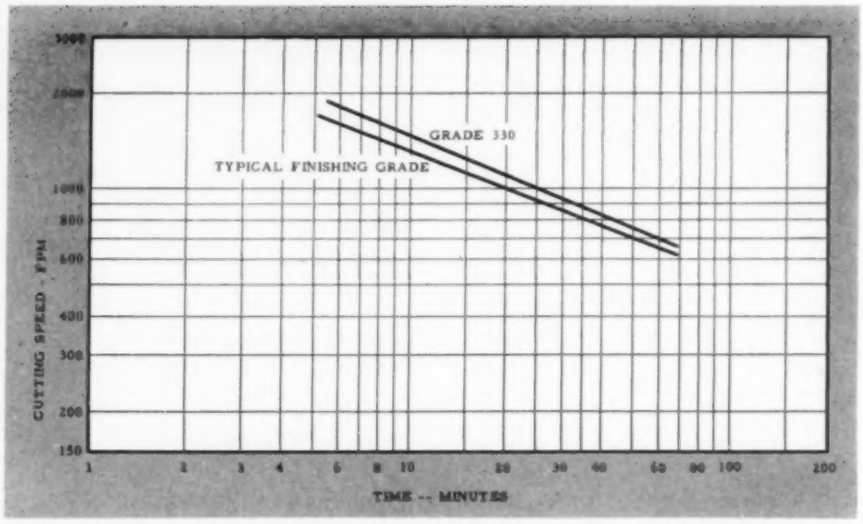
New, Easy-to-Grind, High Titanium Carbide

A new tougher, easy-to-grind, high titanium carbide with nickel binder which promises to improve tool life in precision finishing and boring of steels is reported by Carboloy Department of General Electric Co., Detroit, Mich.

Tests show the new carbide to be much tougher than carbides normally employed for finishing steel and, although it is not quite as hard as cobalt binder type carbides, it is equally wear resistant.

Its transverse rupture strength is about 200,000 psi with hardness about 91.5 Rockwell A. This is almost twice the strength of commonly used finishing carbide grades with hardness less than two points lower on the Rockwell A scale.



Tool life line comparing new Carboloy grade 330 carbide for precision finishing steel with typical finishing carbide in use today. Tests were conducted on AISI 1045 steel hardened between 160 to 170 Brinnell, without coolant. Tool life was based on 0.030-inch flank wear with feed set at 0.002-inch, depth of cut 0.015-inch. Tool geometries: 0° back rake 6° side rake, 7° relief angles on side and end, 15° end cutting edge angle and 45° side cutting edge angle.

PRODUCTION UP 25%

with

ELECTRO-MAGNETIC

Magna-Lock

CHUCK

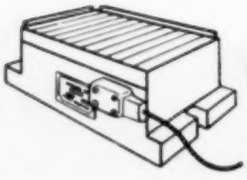
Magna-Lock chuck holds six tapered gibs during roughing operation.

Magna-Lock chuck holds gib during finish grinding.

At GISHOLT MACHINE COMPANY 24" tapered gibs are held by a Magna-Lock chuck during rough surface grinding and finishing. Pieces are rough-ground six at a time, finish-ground singly. Stock removal, .020" to .025". Spindle speed, 1200 r.p.m., table speed, 100 f.p.m. No fixture set-up time is required with the Magna-Lock chuck. There are no rejects, no scrap—production is up 25%.

This is an example of how Magna-Lock's *extra holding power* increases productivity, cuts costs.

Solve your holding problems with Magna-Lock. For complete information, WRITE TODAY, Dept. GF-56.



Hanchett MAGNA-LOCK CORPORATION

BIG RAPIDS, MICHIGAN, U. S. A.

designers and makers of a complete line of magnetic chucks and devices.

Circle No. 246 on postpaid card

The new composition, called grade 330, also can be easily produced consistently to provide a uniform structure. In the finishing area of machining, the new addition takes up where grade 350 leaves off, to round out Carboloy's line of 300 series carbides.

Due to its structure and added toughness, the new carbide is less susceptible to chipping or cracking than currently available finishing carbide grades during brazing, grinding or in use. It can be ground easily on duplicating type grinders and, if accidentally crowded while grinding, it will not crack readily.

When used as a brazed tip, however, the new carbide requires the use of a special flux to provide proper wetting. According to Carboloy engineers, a silicon-bearing type flux used with generally available, lower-melting-point, high silver solders provides satisfactory results.

An indication of the new carbide's toughness, was revealed dramatically in one of several field tests. During this particular test, the carbide was employed as a profile turning tool in machining SAE 1117 steel hydraulic valve lifters. For test purposes, the job was being run at various speeds—between 225 to 750 fpm, with the valve lifters being loaded and unloaded automatically.

Sometimes during the test the work was not fully chucked. This created a terrific work load on the cutting tool. But instead of breaking, the carbide tool was merely shoved back into the tool holder post. Previous carbides, under similar conditions, broke instantly. By resisting chipping or breakage in this particular test the new Carboloy grade 330 provided a tool life better

than three times that of any carbide used previously for machining the lifters. •

Use HANDY Postpaid Card. Circle No. 108

New Lightweight Air Grinder Features Added Power

The latest in a series of advanced air and electric tools being designed, engineered and produced by Thor Power Tool Company to help industry speed production, has been announced by the Aurora, Ill. firm through J. A. Hill, vice president and sales manager.

It is the new 25G rotary air grinder, a streamlined, lightweight unit which is derived from the company's No. 2 series. An outstanding feature is that it produces 23% more power than former models in this series. It replaces Model 00D in the Thor line. The new grinder is now in production and will be shipped to Thor branches during March.

Designed primarily for precision die work, the 25G grinder is equally adapted to production grinding operations in shops and laboratories and to bench duties. Weighing only two pounds, with an overall length of 11½", the tool has a wheel size of 1¾" bonded capacity. It operates at a speed of 20,000 rpm on air pressure of 90 pounds. It has a ¼" air inlet pipe thread and takes a ⅜" minimum hose size.

Chief features of the new Model 25G, in addition to the notable increase in power and the decreased weight, are a reduction in the number of working parts, a 360° adjustable exhaust position, and a thumb-type throttle for more sensitively controlled power feed.

An advantage of this new tool and its 90 companions in Thor's No. 2 series is the complete interchangeability of parts with drills, screwdrivers and nut setters in the same series. Besides grinding wheels, the attachments which can be used with the basic tool include mounted points, rotary files, steel cutters, soft felt and rubber polishers, and wire wheels.

Addition of the new model to this line points up the fact that Thor now offers a versatile line of small air grinders operating at speeds of 7000 to 21,000 rpm, and using bonded capacity wheel sizes up to 3-in. diameter. Button and lever throttle styles are offered and weights range upwards from 1 lb. 1 oz. •

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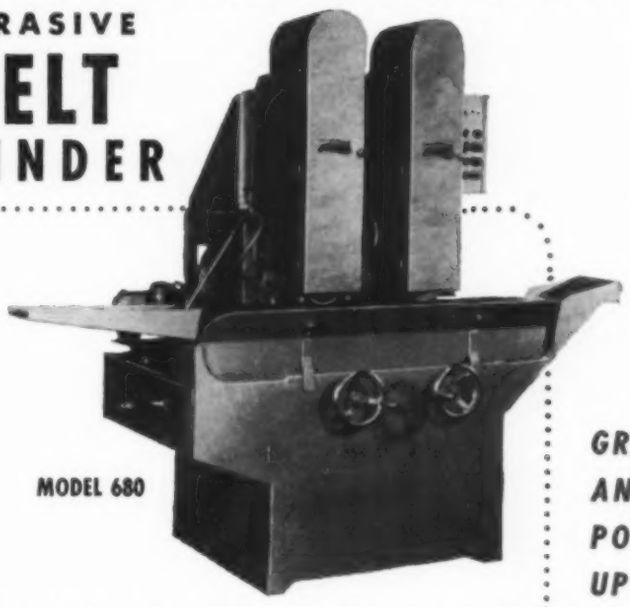
New ENGELBERG

MULTIPLE-HEAD, CONVEYOR-TYPE ABRASIVE BELT GRINDER



MODEL 680

GRINDS AND POLISHES UP TO 100% FASTER (or more!)

Here is a high-production, semi-automatic abrasive belt machine for precision finishing of any flat and many irregularly shaped surfaces. Works on *any* ferrous, non-ferrous, plastic or other material.

Operating wet or dry, the Model 680 increases production up to 100% and more, over conventional grinders. You may simplify fixtures — or eliminate them entirely. Set-up time is reduced substantially: a big saving where short runs are common.

Multiple heads allow you to combine operations which would otherwise be done on several machines or through repeated set-ups of one machine. Single, double or any number of heads are available, powered by 5 or 7½ hp drive — with or without magnetic chuck.

THE ENGELBERG HULLER CO., INC.

SEND US a sample piece or print for cost-and-time-savings estimate. Or ask to have one of our production engineers call to discuss your grinding problems. No charge —no obligation.

THE ENGELBERG HULLER CO., INC.
322 Seneca St., Syracuse, N. Y.

Please send complete information on new Model 680 Multiple-Head, Conveyor-Type Abrasive-Belt Grinder, and name of nearest distributor.

• NAME_____

• FIRM_____

• ADDRESS_____

• CITY_____ ZONE____ STATE_____

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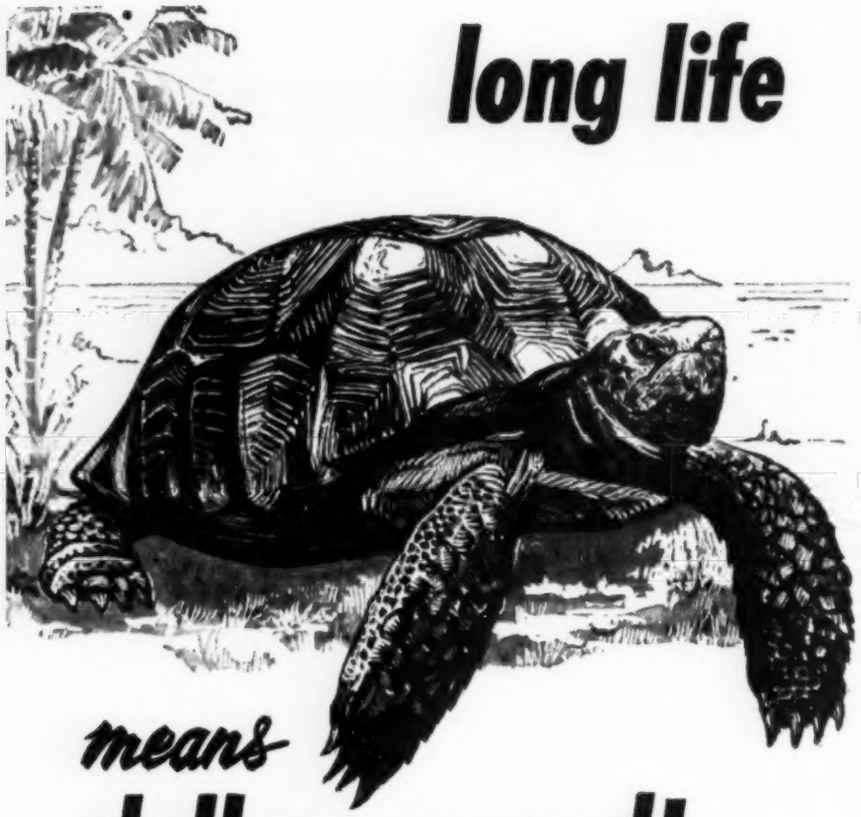


long life

means

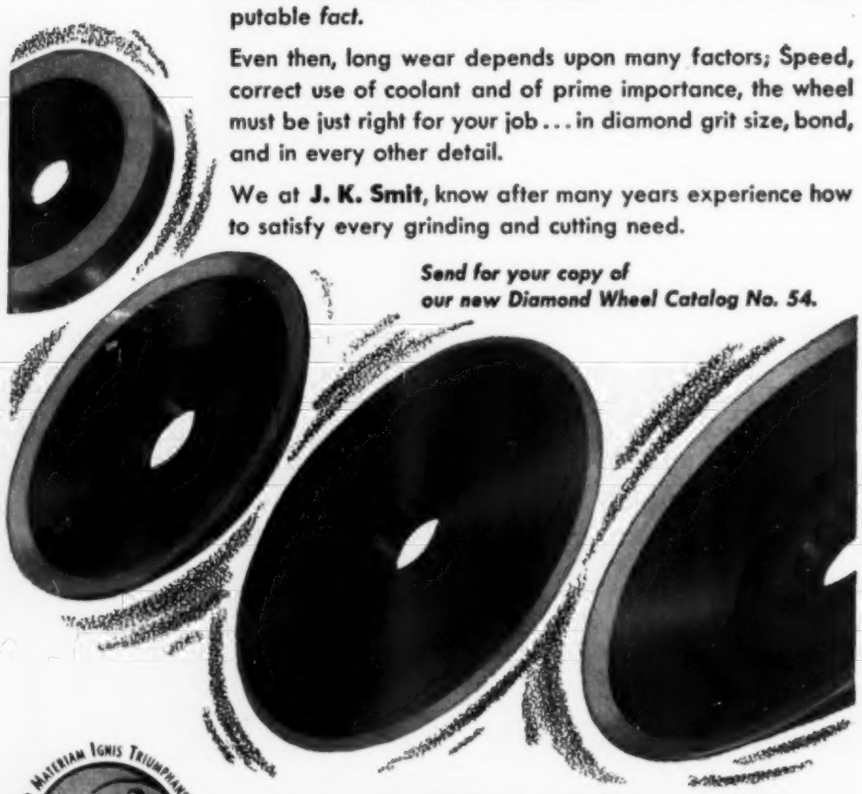
dollars saved!

Whether a 200 year old tortoise would admit this statement is debatable, but with Diamond Wheels it is an indisputable *fact.*

Even then, long wear depends upon many factors; Speed, correct use of coolant and of prime importance, the wheel must be just right for your job . . . in diamond grit size, bond, and in every other detail.

We at **J. K. Smit,** know after many years experience how to satisfy every grinding and cutting need.

Send for your copy of our new Diamond Wheel Catalog No. 54.



J. K. SMIT & SONS, INC.

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New Accessories Boost Uses for Small Contour Projector

A new measuring stage for use in vertical projection is shown on the Kodak Contour Projector, Model 8. This stage may be obtained with micrometers calibrated to .001" or .0001" and provides linear measurements over a range of 2" x 1". Also shown is the new rotary measuring screen for angular measurements to 5' of arc.

Three new accessories to increase the usefulness of the Kodak Contour Projector, Model 8, have been developed by the Eastman Kodak Company and were exhibited at the ASTE show in Chicago last March.

A special glass measuring stage, for use in vertical projection, permits making linear measurements on the projector over a range of 2" x 1". The new stage is available with micrometers calibrated either to .001" or .0001".

For measuring angles, the company has developed a rotary screen which replaces the standard ground glass screen and is used in either horizontal or vertical projection. A vernier scale permits direct readings to 5' of arc.

A third accessory, for use in hori-

Accessory overlay chart holder is shown mounted on the Kodak Contour Projector, Model 8, directly in front and below the rotary screen. Machine is shown in position for horizontal projection.

zontal projection, is an overlay chart holder, permitting the use of existing plastic or ground glass charts of varying sizes on the instrument.

"These new accessories," a Kodak spokesman declared, "help make the Model 8 the most versatile 8″ screen projector available for optical gaging today. Not only can it be used for both linear and angular measurement, it also can be used for both horizontal or vertical projection as desired. In addition, it can be quickly and easily transported anywhere needed in a plant on a special lightweight mobile base which accommodates the instrument in either projection position."

Information on the new Kodak Contour Projector Model 8 accessories may be obtained from the Special Products Sales Div. of Eastman Kodak Co., Rochester 4, N.Y., or from the distributor, Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N.Y. •

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Wet-Blast Unit for Multi-unit Installation

A new Pressure Blast wet-blast unit, the Pressure Blast, Jr., recently announced by the Cro-Plate Co., Inc., 747 Windsor St., Hartford 5, Conn., was designed for multi-unit installation in the larger plant or the smaller shop where the compressed air supply for the operation of this type of equipment may be low. The unit may be operated in conjunction with a 3 hp compressor.

Features are: motor-driven paddle-type agitator for the water and abrasive mix; self-supporting trigger gun to reduce operator fatigue; foot pedal window wash actuator. A venturi in the blast gun raises the abrasive and water mix up from the hopper. •

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newest addition to the BUCKEYE family of abrasive tools

little JEFF the MINI-GRINDER

Weighs in at a mere 3½ ounces!
Only 3¾″ long!
Powerful vane-type motor.
Capacity: ½″ mounted points. (⅛″ collet)
All ball-bearing construction, easy to service.

FOR FINELY DETAILED, PRECISION GRINDING
IN TOOL ROOM OR ON PRODUCTION

At 50,000 RPM, this tiny Buckeye Mini-Grinder stirs up a storm of power that gets an amazing amount of work done in a hurry. No bigger—or heavier—than a pen-type flashlight, the Mini-Grinder can be used for precision grinding in the smallest work areas. Sturdy, all-steel construction. Complete kit, packaged in sturdy tool box, includes mounted points, hose and connections, vitalizer (lubricator-filter), wrenches and dressing stone.

Catalog A-10 contains data and specifications on all Buckeye abrasive tools—write for your copy today!

Buckeye Tools CORPORATION
DIVISION 45 • DAYTON 1, OHIO

producers of the world's first successful rotary air tools

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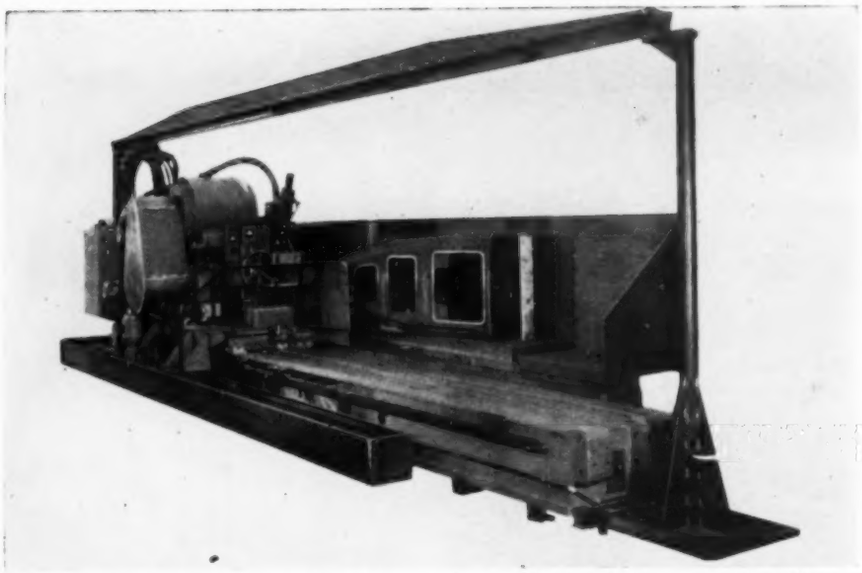
Redesigned Traveling Wheel Face Grinder



Precision grinding of long or bulky workpieces at 90 deg. to the wheel face is a problem solved easily by a Mattison "UK" traveling wheel face grinder. These heavy-duty production machines have now been improved to provide greater horsepower for heavier stock removal and a heavier carriage for improved precision.

Mattison Machine Works, Rockford, Ill., developed the Series "UK" grinders for the awkward jobs that are extremely difficult to do economically, on any other type of equipment. In operation, the part, no matter how large, is clamped in a stationary position and the grinding wheel passes over the surface to be ground. The stationary table permits the use of fixtures and clamps just as heavy as the work demands. There is little likelihood of the piece tearing loose. Work of almost any length can be ground, because one end is supported by the "UK's" table and the other end by supplemental blocking.

Carriage ways are one-third longer and wider in the redesigned machines. Although a heavier carriage is used, the new ways reduce the pounds per square inch loading for better performance. Use of a heavier carriage improves stock removal and precision and a newly designed carriage drive increases efficiency. The carriage is now driven by a variable volume piston-type hydraulic pump in conjunction with a vane-type fluid motor. Complete control of all machine functions is governed by a servo mechanism. Rate of speed, start, stop, inching, and positioning for unloading are controlled by pushbuttons from the operator's seat on the traveling wheel carriage. Speed of the carriage has been increased to a range of 10 to 100 feet per minute. Horsepower driving the grinding wheel has also been boosted throughout the line.

Precision performance possible with the new machines is demonstrated by the fact that in grinding the vertical column of a machine, flatness was held to within .0004 in. over a 60 in. surface. Hand scraping was eliminated. •

Use HANDY Postpaid Card. Circle No. 112

Top-Running Way-Protector

Another forward development in pliable protection for machine tools is this top-supported way-protector. The range of applications includes grinders, millers and boring machines.

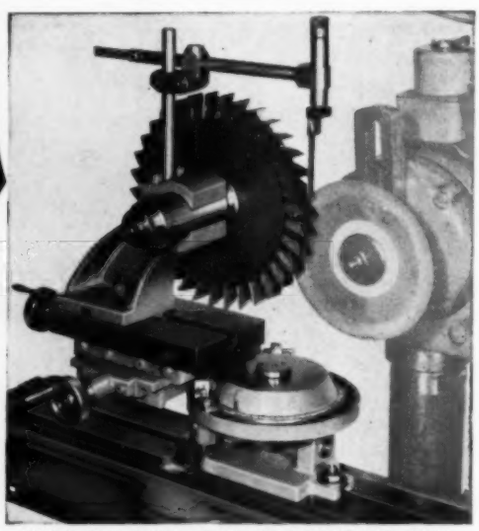
These way-protectors are assembled to permit application on present machines already in service as well as on varying types of new machines on OEM assembly lines.

Each convolution in the new design has its own, metal supporting bridge, and brass, reinforcing gromets, fabri-

THE UNIVERSAL RADIAL CUTTER GRINDING FIXTURE

Does 5 Operations without removing cutter from its ARBOR!

On cutters up to 8" in diameter, the No. 6 fixture, as shown with our No. 6A heavy-duty, right-angle, ballbearing spindle workhead:
Sharpens side teeth on **both** sides.
Sharpens peripheral teeth.
Generates small or large radii on **both** corners of each tooth.
(Other workheads available)

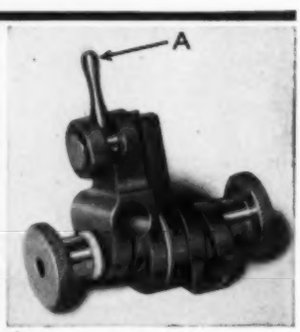


▲ THESE DEPENDABLE GRINDING FIXTURES SAVE THE LIFE OF YOUR CUTTERS. Write for our catalog 603

◀ UNIT 1A
This Universal Cutter Grinding Fixture fits any universal tool or surface grinder.

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes. ▼

▲ UNIT 4A
Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.



▲ NEW FINE-ADJUSTMENT SLIDING SWIVEL GIVES SMOOTH, PRECISE INDICATOR SETTING. Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A".
WRITE FOR: SLIDING SWIVEL FOLDER

ROCHELEAU TOOL & DIE CO.
650 North Main St., Leominster 1, Mass.

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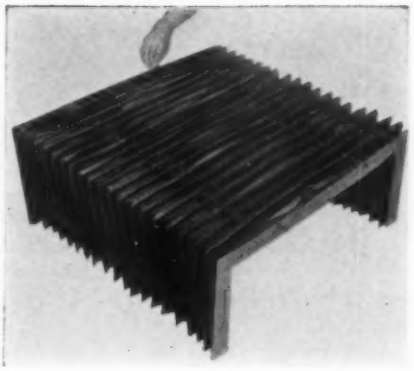

cated integral with the convolutions, maintain the freedom of travel forth and back on the top-supporting guide rods. No wear takes place directly on the convolutions either at top or bottom. Bottoms of the protectors extend over the bed edge to prevent entry of dust from beneath the way-protector.

Top-running, equalizer-spacer strips evenly distribute the pull on all convolutions. End mounting plates, for attachment to bed or tool-frame, are cut from aluminum plate.

duPont Fairprene .050, a neoprene-base material, is most commonly used in the fabrication. Dimensional drawings which show application details may be obtained from A&A Mfg. Company Inc., 2017 W. Clybourn St., Milwaukee 3, Wis. •

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WALLS TU-WAY BELT SANDER

Full 1/3 h.p. G. E. Motor

USE IT EITHER WAY

VERTICAL

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use $89.95

Illustrated Literature on Request

A few desirable distributer territories still available.

WALLS SALES CORPORATION

333 Nassau Avenue Brooklyn 22, N Y

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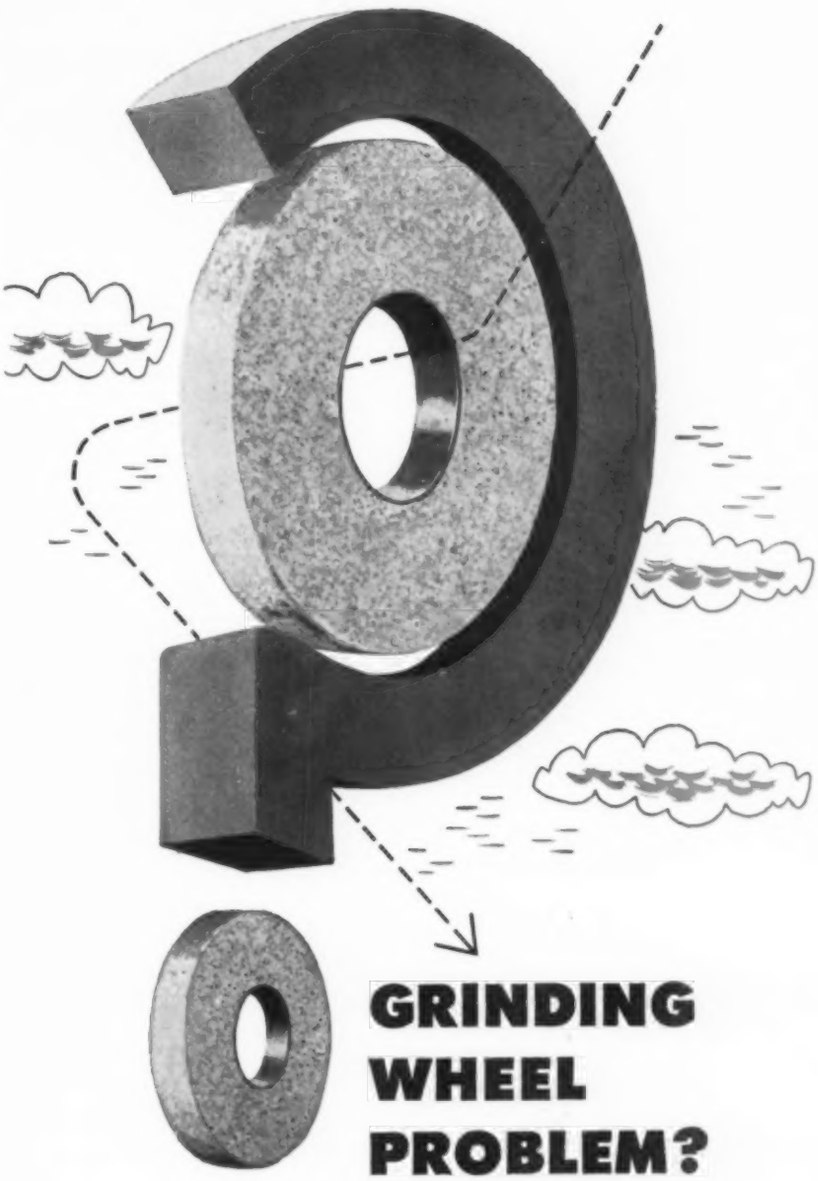

GRINDING WHEEL PROBLEM?

We like to keep our engineers on their toes solving new and tough grinding wheel problems.

What are some of your "hard-to-do" grinding jobs—could be we can make them "easy-to-do"!

Write for details or the name of your nearest distributor.

SWWC TRADE MARK

SIMONDS WORDEN WHITE COMPANY

1101 Negley Place • Dayton 7, Ohio

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Double End Tool Grinder

Equipped for either wet or dry face grinding of large, single-point tools, a double-end tool grinder is being offered to manufacturers by Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Designated as Style 48-B, the grinder can be used for roughing out all sizes of shanks. With suitable wheels the machine will recondition tools of high speed steel, cast alloys and carbides.

Two 10-inch plate mounted wheels are used. The wheel shaft rotates in heavy-duty double-row ball bearings, permanently lubricated and sealed against entry of dirt and abrasive particles. The spindle drive is through a V-belt from a reversible motor located in the base of the grinder. Ample tool rest tables are adjustable to required tool sharpening angles, and may also be adjusted to compensate for wheel wear.

Carefully engineered safety features are standard with the machine. Included are heavy sheet metal guards attached to the table brackets, and moving with them. These prevent tools from dropping into the wheel recesses. Other conventional guards also insure safety for the operator.

A pressure coolant system, having its own tank and pump, is provided with the 48-B Tool Grinder. Coolant at each wheel is controlled by an individual valve and splash guards prevent waste of coolant when the grinder is operating.

An accurate protractor tool guide, a universal adapter for grinding the top rake of tools, a diamond wheel dresser and tool holders for both round and square tools are available as extra equipment. •

Use HANDY Postpaid Card. Circle No. 114

Sectional Impregnated Abrasive Buff

A new sectional impregnated abrasive buff, for the buffing of all ferrous and nonferrous metals, has been developed by the Coated Abrasives Div. of The Carborundum Co., Niagara Falls, N.Y.

Selected from several designs after exhaustive tests, this new pleated type sectional abrasive buff will be of significant interest to all regular users of traditional non-impregnated buffs. Heretofore, the greatest cost element has been for abrasive cake and compound in stick or liquid form, applied to the buff—ranging from 12 to 24 times the cost of the non-impregnated buff itself. Carborundum's impregnated buff is a successful attack on this cost.

Engineered of specially-treated biased cloth, impregnated with abrasive grains bonded throughout its construction, the new sectional impregnated abrasive buffs are competitive to sisal buffs, in the finer grit sizes, for normal cut-down operations to prepare surfaces for color buffing or plating—or both. In the coarser grit sizes they are competitive to set-up wheels, coated abrasive belts, Tampico brushes and other polishing and buffing devices.

They can be altered by the use of conventional spacers to adjust cutting action and to provide greater coverage. Some potential applications may require widths up to 50". Normal side supports and flanges can be used. •

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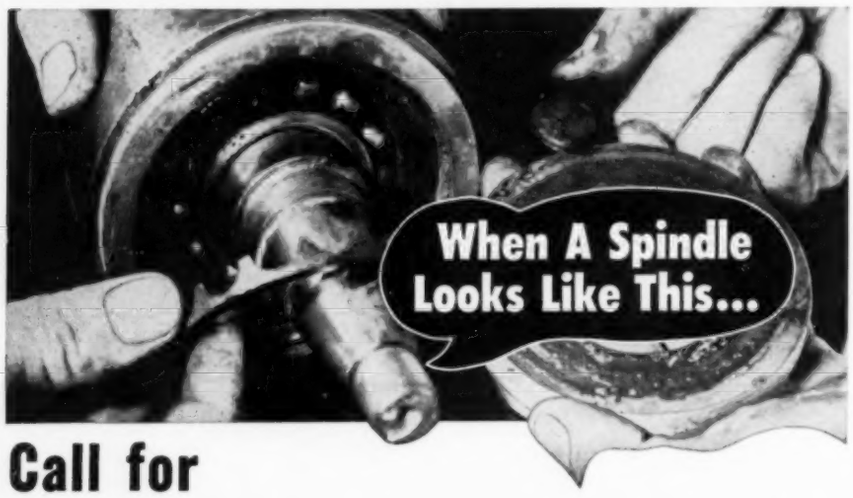

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All Types and Makes of High Speed Internal and External Grinder Spindles or Quills and Hi-cycle Units . . . Anti-Friction Live Centers

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Gentlemen:
Please send me complete information on your spindle repair and rebuilding service.
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Circle No. 253 on postpaid card

Visible Grinder Eliminates Trial-and-Error Grinding

A new bench grinder, recently introduced in the United States by Carl Hirschmann Co., Inc. of Manhasset, N.Y., permits the operator to see right through the wheel to keep the work-piece surface under constant observation. The new method utilizes a specially designed unbreakable wheel, which when rotated horizontally at 3,600 rpm creates a stroboscopic effect making the wheel, in effect, transparent.

The Visible grinder takes very little bench space (5¼" x 6¼") and knurled thumb nut permits quick wheel changes. Because the wheel rotates in a horizontal plane, sparks and dust are carried away from the operator greatly reducing the possibility of accidents. Another interesting feature is the turbine-like slots in the wheel which when in operation, air-cool the wheel and the work-piece, reducing overheating and loss of temper in the piece being ground.

A variety of wheels are available for ferrous and non-ferrous metals, plastics, etc. Various grits are available for every application. •

Use HANDY Postpaid Card. Circle No. 116

New Cone Shaped Barrel Finishing Media

A new barrel finishing media—conical ceramic shapes—has been announced by Minnesota Mining and Manufacturing Co., Dept. F6-48, 900 Fauquier St., St. Paul 6, Minn.

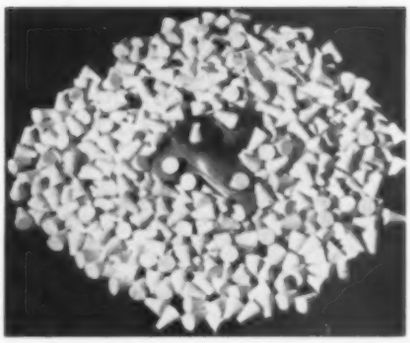
Called "Honite" brand Ceramicones, the new media makes it possible to barrel finish intricate parts which previously could not be finished in this manner because of lodging problems.

The tapered ends of the media permit access to holes for deburring, yet the broad bases prevent lodging; and the cones' resistance to wear enables them to maintain their original dimensions over a long period of time, according to the 3M Company.

The media will also remove burrs and parting lines from molded plastic parts without scratching the fine surface produced in molding.

The cone-shaped media minimizes the dangers of contamination because the ceramic material is fused under high pressure to eliminate voids and resist deteriorating effects on acids.

The cones are ½" high, ⅜" through the base and 7/32" across the top. Because of the cone-shape, there is a surface on the media for reaching virtually every surface on the work piece. •



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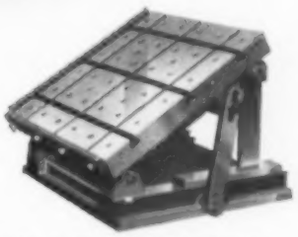
Robbins ...THE COMPLETE LINE OF ANGULAR TOOLING EQUIPMENT

Save dollars in valuable tool room time on every job! Set-ups that require hours by other methods take minutes the Robbins way. Just four simple steps: (1) Look up required angle in Table of Constants furnished with each tool, (2) Select gage blocks from the Table, (3) Place gage blocks between base of unit and sine bar swivel block, (4) Secure the work . . . and you're ready to go! Complete range of models and sizes brings Robbins precision equipment within the reach of every shop, large or small.



HEAVY DUTY SINE PLATES FOR MILLING AND BORING

Fool proof! Rugged enough to take thrust and chatter of heavy cuts . . . yet built to tool room accuracy for the most exacting inspection operations.

"MAGNA-SINE" MAGNETIC TABLES FOR PRECISION GRINDING

Set up and grind any single or compound angle fast! Work is held securely by magnetic attraction, clamped or released in an instant. Work can't warp or move.

INSPECTION SINE PLATE FOR EVERY INSPECTION OPERATION

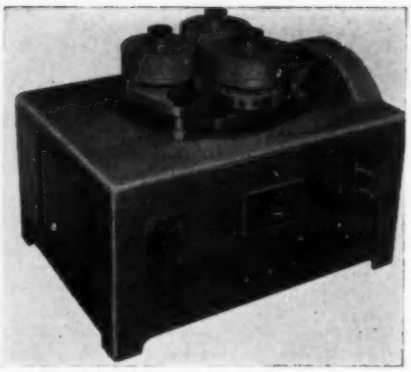
Eliminate chance of errors in inspection department and tool room! No more V-blocks, angle plates, or complicated built-up sets of blocks. Simple, fast and sure.

Write or call for complete information now!

OMER E. Robbins COMPANY
24800 PLYMOUTH ROAD DEPT. H-7 DETROIT 39, MICH.
Also producers of special machinery, gages and fixtures

Lapping Machine Finishes Hardest Carbide Tool Inserts

A new self-contained, semi-automatic lapping machine designed to completely grind carbide tool inserts and "throw-aways" has been announced by Empire Corp., 1566 S. 83rd St., Milwaukee 14, Wis. Reported to cost less than the average diamond abrasive wheel, the new multiple tool lapper uses readily available domestic abrasives in a fast, accurate grinding operation that requires a minimum of labor and materials, providing a finish even on hardest grades of carbides that is said to



provide more cuts per tool than new carbide inserts.

The lapper is semi-automatic in operation, requiring only loading and unloading. Tool holders are available to accommodate all standard triangular, round and square inserts or throw-aways. Once loaded, the machine requires no further attention until the grinding operation is completed. It provides consistent and controlled micro-finish on tools, with end sections maintained parallel and square to the axis of the tool. Tool life is increased by the introduction of compression stresses in the face of the tool. Machine is furnished with one set of three tool holders, one charge of abrasive, and loading fixture, ready for operation. Entire unit requires only 18" x 24" bench space, operates on 110 volt, ac current, and requires only 200 watts power. •

Use HANDY Postpaid Card. Circle No. 118

Diamond Powder Compound in Tubes

Diadem, a diamond powder compound consisting of selected diamond particles in a permanent viscous suspension, is now packaged in a new, convenient Bracon squeeze-to-use tube of clear polyethylene plastic.

Diadem is a product of United States Industrial Diamond Corp., of New York, and is packaged in 5 gram tubes. The customer may choose from a variety of micron sizes (the size of the diamond particles in suspension). The micron sizes are identified by a color code and the corresponding color of the compound is matched by the tube cap.

The handy tube makes previously inaccessible places easy to reach. To apply, the user simply unscrews the cap and squeezes to use, thus doing away with the necessity for applicators.

Diadem diamond powder compound is ideal for any grinding or lapping operation where diamond particles are a must. It is an excellent micro-finishing compound perfectly suited for use by metallurgists, researchers, or in the tool and die, electronics, rubber, wire or ceramics industries. •

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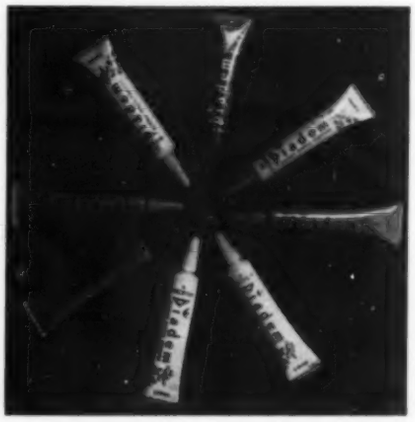

ROTO FINISH

it's the finish that counts!

Roto-Finish maintains exact tolerances on precision parts with no significant dimensional changes. It makes possible a wide range of finishes applicable to parts of almost any size or shape; finishes a variety of materials — at big savings in manpower and costs. Without obligation, send sample unfinished parts to us. Include finished part for guide and your specifications. Roto-Finish will finish parts in its laboratory. You get a complete process report. You are guaranteed results and a finish that counts!

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Originators of the Roto-Finish Process

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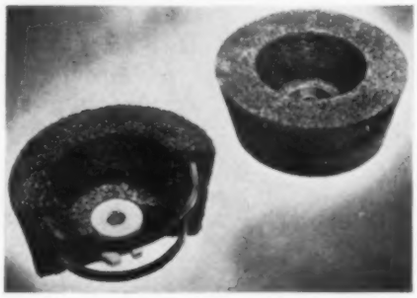
Resinoid Grinding Wheels Feature Safety Rings



Cut-away photograph shows a resinoid grinding wheel for portable grinders, having two rings embedded directly in the usable portion of the wheel, called Grind-Away safety rings. They are claimed to have greater tensile strength than steel, but will abrade away during the normal cutting of the wheel without any interference to the grinding action.

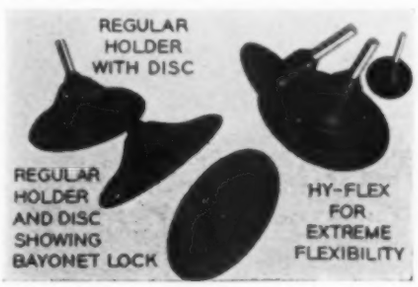
This makes it possible to reinforce the wheel where the actual reinforcement is needed. Rings provide the strength where the grinding is taking place. Tests run show that cracked wheels have been run up to 20% above normal operating speed without the wheel exploding. This safety feature has been extended at present only to straight wheels, and type 5, 6, and 11 cups for portable grinders. Colonial Abrasive Products Co., Conshohocken, Pa. •

Use HANDY Postpaid Card. Circle No. 120

Coated Abrasive Discs and Locking Holders

New, instant, sure locking Contur coated abrasive discs and flexible rubber disc holders, ideal for grinding and polishing all surfaces, flat to extreme inside or outside contours, are now available from Foster Supplies Co., 6122 Milwaukee Ave., Chicago 30, Ill. They follow the surface, grinding cleanly and without gouging, and are used extensively on molds, dies, forgings, castings, weld joints, metal patterns, aircraft parts, etc.

Discs are self-centering, balanced and bayonet lock firmly on Contur holders with a twist of the wrist. No loosening from heat caused by grinding. They are available in grits from 24 to 320 and in 6 sizes, ¾" to 4".



Contur flexible rubber disc holders and Hy-Flex holders are made for 6 disc sizes. Shanks are ⅛", ¼" and ⅜" according to the holder size. Hy-Flex holders are used where extreme flexibility is needed. •

Use HANDY Postpaid Card. Circle No. 121

Dual Action Sanding Machine

A new type of sanding machine has been announced by the Detroit Surfacing Machine Co., 1333 E. Eight Mile Rd., Detroit 20, Mich. This completely new type of air powered sander is really two units in one. Sanding action moves in two directions at the same time, turning 6000 rpm's to the right, and at the same time moving in a fast reverse action to the left.

Results of this feature are a faster cutting and sanding action, and an important savings in abrasives.

A simple device known as the Shift Ring, instantly converts the unit to a high-speed off-center spinner. The off-center action reduces normal abrasive swirls to a minimum enabling workmen to actually polish steel as well as non-ferrous metals, producing down to 10 micro-inch finish. •

Use HANDY Postpaid Card. Circle No. 122

Cutting or Grinding ALUMINUM?

Use INTERNATIONAL 131-A

The ONE Coolant that Gives You All of These Advantages:

- **NO METAL DISCOLORATION**
  Does not stain aluminum or its alloys—regardless of concentration used.
- **INCREASES TOOL LIFE**
  Prevents welding of chips to tool.
- **CUTS WHEEL DRESSINGS**
  Retards loading of grinding dust on wheel.
- **DOES NOT REACT WITH ALUMINUM DUST**
  No contamination—sanitary in every way.
- **NO SKIN IRRITATION**
  Operators approve International 131-A.
- **SUPERIOR FINISH**
  Profilometer readings of two micro-inches or less are readily obtained. Fewer rejects.

International 131-A Gives Outstanding Results on Stainless Steel Too!

It will pay you to get the facts about International 131-A. Write for information.

INTERNATIONAL CHEMICAL COMPANY
Specialists in Cleaners and Coolants for Industry
2628 N. Mascher Street • Philadelphia 33, Pa.

Circle No. 256 on postpaid card

Portable Etching Tool Features Simple Operation

Up to date shop practices demand that all high speed steel tools, drills, reamers, milling cutters, samples of steel, metallurgical specimens, dies, jigs and expensive special tools be carefully marked for identification.

Modern shops can't afford to use slow, old fashioned or unsatisfactory marking methods. Luma Electric Equipment Co. of Toledo 1, Ohio is manufacturing the Luma Combination Etchtool for marking and demagnetizing in the same operation.

Acid with its fuss, muss and liability to rust and ruin expensive tools is the old way of doing the job. Marking tools before hardening with steel stencils and a hammer is in some cases necessary, but it is slow and there is always the risk of fracture in hardening and many times the marking is overlooked. It is just as easy to mark hardened steel electrically with a Luma Etchtool as it is to write with an ordinary lead pencil and just as quick.

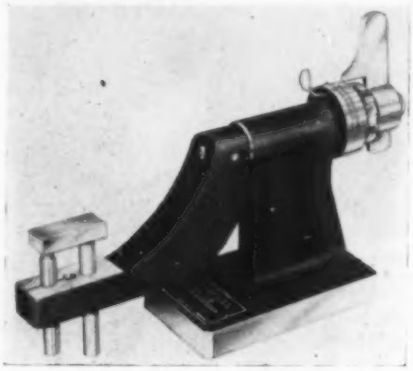
Etchtools are practically fool-proof, operate from alternating current light socket and with ordinary care are as free from trouble as an electric fan or vacuum sweeper. Anyone is able to use them after fifteen minutes practice. It is so simple to operate a boy or girl can do the job.

They are extremely portable, require no permanent installation and can be carried any place and used wherever there is an ordinary ac light socket.

It will mark and demagnetize simultaneously or separately and has three stages of marking control, light, medium and heavy, which is entirely adequate for the usual marking demands in the tool room. It is a small compact unit, contained in an aluminum box, approximately 5 inches wide by 8 inches long and 3 inches deep, and weighs 15 pounds. •

Use HANDY Postpaid Card. Circle No. 123

Radius Dresser



A high quality radius dressing tool is currently being introduced by the Rothfuss Tool Co., Box 202 Elmwood Station, Providence 7, R.I.

Called the Rothfuss G-5, this low cost radius dresser is precision engineered to go along with the company's G-2 Angle Dresser which together can dress radii and angles tangent to each other. The G-5 will dress either a convex or concave radius from .015" to 1.750" on any grinding wheel up to 10" in diameter.

This new tool has graduated stops that allow the operator to dress any portion of a wheel's radius. A major feature incorporated in the G-5 is its spring tension journal that insures chatter free operation. •

Use HANDY Postpaid Card. Circle No. 124

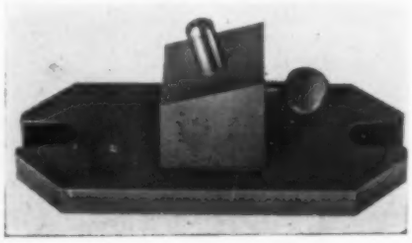
Diamond Nib Holder

No. DH-15 is the trade name for a new diamond nib holder to be used on surface grinders. It allows the nib to be brought in contact with the wheel at a 15° angle thereby restoring the accuracy to cutting action of the grinding wheel. It allows for hand turning the nib thereby constantly maintaining a point on the diamond.

This tool holder can be bolted direct to the table or used on a magnetic chuck. It is made of solid steel and weighs two pounds. There are no parts to wear out and it will serve the user indefinitely.

It can be used with any size diamond nib for use on any size grinding wheel. The Desmond-Stephan Mfg. Co., Urbana, Ohio. •

Use HANDY Postpaid Card. Circle No. 125



Tough Grinding Wheel Forms Dressed Easy as A, B, C

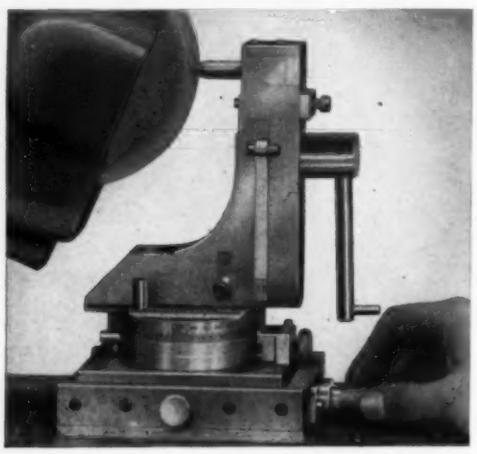
eliminate elaborate set-ups and operations

.0001" ACCURACY

Fluidmotion

WHEEL DRESSERS

dress two angles tangent to a radius in one continuous motion



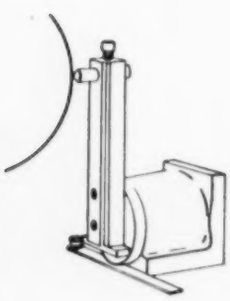
With the unique "Fluidmotion" Dresser, you can dress two angles tangent to a radius — using one handle in one continuous motion. Operation is so fast and simple that beginners can use them.

Adaptable to all type cylindrical and surface grinders.

A. Obtain micrometer reading; add required convex radius or subtract required concave radius.

B. Loosen jib with wrench and "mike" over lower pins to reading obtained above.

C. Tighten jib. Set stops for two angles. Ready for action.



Also available: "FORM MASTER" Dresser, capable of dressing any radii up to 12" convex, up to 15" concave. Prices start at

$45.00

WRITE FOR INFORMATION ON THE NEW J & S PURCHASE PLAN

See your industrial distributor or write for free literature.

J&S TOOL CO. INC — CLAMPCUT

J & S TOOL CO., INC. | **871 DORSA AVE. LIVINGSTON, NEW JERSEY**

Circle No. 257 on postpaid card

Heavy Duty Grinder

The Standard Electrical Tool Co., 2486 River Rd., Cincinnati 4, O., has announced their improved design Grind Air-rester. This 12″ or 14″ heavy duty grinder with self-contained dust collecting unit is built according to the Safety Code. The dust control system is built inside the grinder base, thus minimizing the overall floor space.

A motor driven material handling fan operates simultaneously with the grinder motor. The dust collecting chamber has a gravity feed of collected materials to the dust drawer; this dust drawer is easily removable for discarding the grit and dust. The steel wool filter pads are renewable and when required, are replaceable.

The Type 2GAR 2 hp grinder motor serves two 12″ x 2″ wheels, while the 3GAR 3 hp is for 14 x 2½″ wheels. The grinding wheels are protected by safety guards which are adjustable to wear of grinding wheels; each guard has 4″ diameter exhaust outlet, hinged door, spark breaker and work rest. Tool tray with removable water pot at front of pedestal. Optional equipment is plain or illuminated eye shields. •

Use HANDY Postpaid Card. Circle No. 126

Flexible Abrasive Strip

The L. B. Miller Co., 394-6 State St., Stamford, Conn., is manufacturing flexible abrasive strips for dressing contact points and commutators on many kinds of apparatus, and for removing burrs where it is not practical to use a file. Being a non-conductor, it eliminates any hazard that may prevail when a file is used. The prime feature is the flexibility. They come packaged in a container of 12. •

Use HANDY Postpaid Card. Circle No. 127

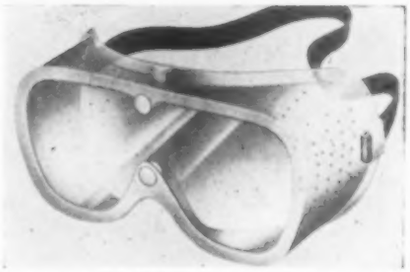
Single Lens Safety Goggles

New, Soft Side, single lens, Welsh safety goggles are recommended for light grinding, chipping and chemical operations.

Long wearing comfort provided by soft, pliable, vinyl plastic frame in crystal clear or green, adapts readily to any size or shape of head.

Deep frame design gives greater clearance over prescription spectacles and fits snugly along temples.

Single piece, extra large, clear or green lens of impact resistant cellulose acetate provides unobstructed, wide angle vision. Vinyl lens available for chemical operations. Two positive snap fasteners make lens replacement easier and quicker.



Available in four ventilation styles. Regular perforations for average conditions—Screened Ports for extreme dust conditions—Baffled ports for acid and splash conditions—No ventilation for vapor conditions. Welsh Mfg. Co., 24 Magnolia St., Providence, R.I. •

Use HANDY Postpaid Card. Circle No. 128

POPE PRECISION SPINDLES for BORING • GRINDING • MILLING

An exhibit of the latest and finest in Spindle design and performance, to reduce your tolerances and production costs.

You can specify POPE PRECISION SPINDLES with Confidence

EXHIBIT A

POPE SUPER-PRECISION, HEAVY DUTY BORING SPINDLES for boring holes round within millionths of an inch. Available in both belt driven and motorized units to meet a wide range of speeds and horsepower. Send us your specifications for quotations.

EXHIBIT B

POPE 1 HP, TOTALLY ENCLOSED 3600 RPM MOTORIZED, CARTRIDGE TYPE PRECISION SPINDLES with double row cylindrical roller bearings and separate thrust bearings for no endwise movement of the shaft

EXHIBIT D

POPE HEAVY DUTY, ¾ TO 100 HP DIRECT MOTORIZED SPINDLES for Horizontal or Vertical Skin Milling, Grinding, Milling, Boring and Other Operations

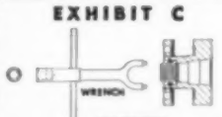
EXHIBIT F

POPE HEAVY DUTY VEE-BELT DRIVEN, PRECISION MILLING SPINDLES, and Wheel Heads, ½ to 50 HP

EXHIBIT G

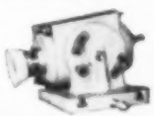
POPE INTERNAL GRINDING SPINDLES for Bryant, Excello, Heald and Landis Grinders.

EXHIBIT C



NEW POPE QUICK, SELF-REMOVING WHEEL HOLDER for surface grinders and tool and cutter grinders — eliminates the necessity of a wheel puller. Write for quotations.

EXHIBIT E



POPE SUPER-PRECISION MOTORIZED TOOL AND CUTTER GRINDER SPINDLES with clearance Angle Swiveling Heads for *Angular Adjustment In A Vertical Plane*

EXHIBIT H

POPE SUPER-PRECISION HIGH FREQUENCY HEAVY DUTY GRINDING AND MILLING SPINDLES for speeds up to 100,000 RPM

WRITE FOR COMPLETE SPECIFICATIONS, PRICE AND DELIVERY

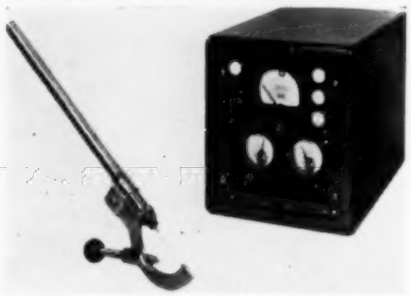
No. 110

POPE MACHINERY CORPORATION
261 River Street
Haverhill, Massachusetts
Established 1920

Builders of the Revolutionary New POPE Super-Precision Boring Machine That Bores Holes Round Within Millionths of an Inch.

Circle No. 258 on postpaid card

Automatic Grinder Control



An electronic unit for automatic control of plunge grinders has been announced by the Industrial Products Department of Airborne Instruments Laboratory, 160 Old Country Rd., Mineola, N.Y. Known as the MICROtrol type 150, the unit gages workpiece diameter continuously during grinding, and uses the gaging information for automatic control of final size of the workpiece.

When used with a grinder that is equipped with electrically-operated feed control and wheel withdrawal devices, the MICROtrol unit automatically controls such variables as the change from fast infeed to slow, amount of stock removal during sparkout, and wheel withdrawal at final size. In addition, part size is continuously presented on a set of direct-reading indicators, and indicator lights signal arrival at the various size limits, including final size.

The major advantages of the control unit, which can be installed without difficulty on either new or existing grinders, include reduction in scrap through better control of final size. This, in turn, is accomplished by the automatic multi-point control of wheel feed and withdrawal. An additional advantage is the improvement in surface finish, brought about by the accurately controlled sparkout. In some applications, the improvement in surface finish has been sufficient to eliminate the need for honing after grinding.

The standard MICROtrol type 150 is for true diameter gaging on center-type grinders, with three-point grinder control and wheelguard-type mounting for the gaging caliper. Special units are available for other applications, such as chordal gaging on external centerless grinders. •

Use HANDY Postpaid Card. Circle No. 129

Power Tilt Tumbling Barrels

The Model DM-PT series is the newest in the line of Globe tumbling barrel equipment, manufactured by the Globe Div., Casalbi Co., 544 Wayne St., Jackson, Mich. The Model DM is engineered for versatility and operator convenience. The power tilt provides easy loading, rinsing and unloading. Push button control starts, stops and regulates up and down movement.

Cubical content ranges upward to 23 cubic feet and maximum load capacity of the largest Model DM is 1500 lbs. All 5 models are available with round, octagonal or flask type shells, made of hard maple or steel (with or without neoprene lining).

Optional electrical equipment meets latest JIC specifications. All models are available with variable speed motor. •

Use HANDY Postpaid Card. Circle No. 130

Sandwich Refractory Slab

Sandless firing or vitrified grinding wheels is now possible through development of a new type of "sandwich" refractory slab by Electro Refractories & Abrasives Corp., Buffalo, N.Y.

The slab, or batt, is called a sandwich because it consists of two outer layers either of mullite or zircon with a silicon carbide center. The stronger sandwich-type construction prevents warpage even after many firing operations. The inert facing eliminates sticking.

It thus eliminates the sand which is used to fill in uneven spots on the surface of ordinary refractory batts. This sand often sticks to the wheels during firing and must be removed later. •

Use HANDY Postpaid Card. Circle No. 131

NO. 1 *"Roughing it"* with Reddy MacFlint

"Tricky shot — smooth club ... what a finish! You know AP Jewel Brand Belts are used to finish the finest 'woods' including brassies and drivers that combine metal and wood."

"Smoothing the way where the going is rough"

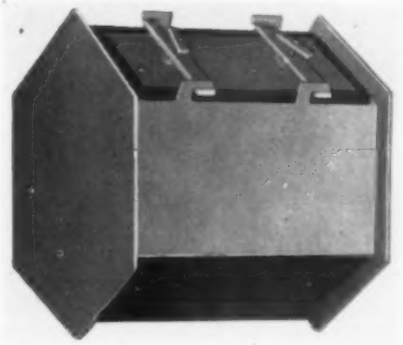
Frequently AP salesmen are able to provide unusual service in supplying abrasives because their plant is neither too big to lose the personal touch nor too small to lack emergency capacity.

Abrasive Products, Inc.

South Braintree 85, Mass.

Circle No. 259 on postpaid card

Barrels for "Build-Your-Own" Tumbling Machines



The Rampe line of replaceable, precision finishing barrels, ranging in size from 1 gallon to 8 cu. ft. capacity, may be purchased individually for replacement with Rampe equipment or for Do-It-Your-Self shops, who wish to build their own tumbling machine. Turn table or flange mounting plates are also available.

The complete list of attachable barrels made is as follows:

1 gallon—closed hexagonal barrel
1 gallon—open conical barrel
5 gallon—closed hexagonal barrel
7¼ gallon—open conical barrel
1.1 cu. ft.—closed hexagonal barrel
2 cu. ft.—closed hexagonal barrel
4 cu. ft.—closed hexagonal barrel
6 cu. ft.—closed hexagonal barrel
8 cu. ft.—closed hexagonal barrel

The larger sizes are 23" in diameter. —Other sizes are smaller. •

Use HANDY Postpaid Card. Circle No. 132

Plain Angle Wheel Dresser—Dresses Angles in Seconds

A new inexpensive plain angle wheel dresser has been announced by J & S Tool Co., Inc., 87 Dorsa Ave., Livingston, N.J., manufacturers of the Fluidmotion line of grinding wheel dressers, known as the Angle Master wheel dresser. This new unit combines precision accuracy together with durability for applications requiring low cost units.

This sturdily designed plain angle wheel dresser is said to be 100% dustproof. All dresser parts are precision ground. Sealed ball bearings are used to provide a rugged and dependable tool for long service. Mehanite base permits drilling and tapping of holes when needed for quick set-ups on cylindrical grinders. As found in the more expensive dresser models, the Angle Master dresses with the diamond point horizontal to the center of the spindle. •

Use HANDY Postpaid Card. Circle No. 133

Bond Segments

V-40 bond segments, for grinding all ferrous and non-ferrous metals, have been developed by The Carborundum Co. and are now commercially available for immediate delivery.

Made of the highest grade of aluminum oxide abrasive grain, and with the same specially engineered bond as developed for Carborundum's widely accepted V-40 tool room grinding wheels, the V-40 segments are made in the variety of shapes used in all standard chucks.

These abrasive segments have been specially designed for generating flat surfaces on plates, castings and machine parts and grinding machine knives.

Thoroughly field tested, the V-40 segments have shown outstanding advantages over other segments in cooler cutting action, longer life and better size-holding ability. They are also more uniform in structure, and quality control from raw material to finished segments insures uniform duplication in repeat manufacturing runs. •

Use HANDY Postpaid Card. Circle No. 134

SANFORD
SURFACE GRINDER
MODEL MG

For Dry or Wet* Grinding!
PRECISION • SPEED • SENSITIVITY

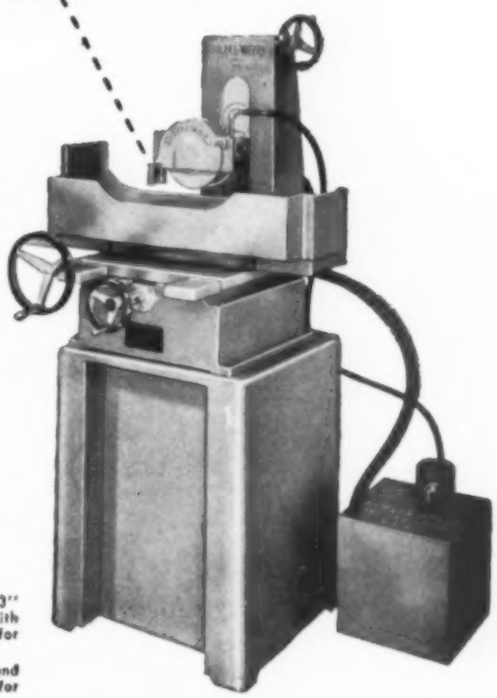
Built by manufacturers who concentrate on small grinders only, each Sanford Grinder is an individual project of time tested and proved basic design. Although modest in price, no quality undermining shortcuts are employed to reduce manufacturing costs. Constant repeat orders prove its acceptance.

This sensitive machine grinds to micro-inch accuracy with no vibration, with maximum dimensional stability. Here's why:

- Transverse ways are double Vee (VV) Mechanite inserts instead of flat surfaces which depend upon unstable jibs for alignment and accuracy.
- Needle, Ball and Oilite Anti-Friction bearings are used throughout.
- Alignments are electronically checked for accuracy.
- Precision slides are ground, lapped and hand spotted.
- Dials are large and legible.

SPECIFICATIONS — 8¼" transverse — 13" longitudinal—12" vertical under 7" wheel with Adapter. Approximate weight 630 lbs. Send for illustrated bulletin.

Replacement parts, special attachments and reconditioning facilities are available. Send for price list.



*With optional equipment

SANFORD MANUFACTURING CORP.
1026G Commerce Ave., Union, N. J.

Circle No. 260 on postpaid card

High-Alumina Ceramic

Type R-65 ceramic, a new high-alumina material having improved electrical and mechanical characteristics, has been developed by Raytheon Manufacturing Co., for use in insulators and hermetic ceramic-to-metal seals. Custom-designed shapes of this material are now available to the electrical, aviation, nuclear, and chemical industries to meet a wide variety of needs.

Mechanical properties include extreme strength and hardness combined with high resistance to abrasion and temperature (up to 1700° C), as well as exceptional mechanical and thermal shock characteristics. R-95 ceramic parts can be metalized for subsequent soft or hard soldering to metals. Electrical properties are equally favorable, with a dielectric constant of 8.61 at 1000 mc.

R-95 ceramic is recommended for either small or mass-production quantities in any application (electrical, mechanical, chemical, or vacuum) requiring a precision ceramic of uniform body composition and consistent quality.

Data is available and application inquiries are invited. Quotations on ceramic items or ceramic-to-metal assemblies made to customers' specifications will gladly be supplied. Address: Raytheon Mfg. Co., Ceramic Sales, Waltham 54, Mass. •

Use HANDY Postpaid Card. Circle No. 135

Combination Safety Cap and Goggle

Supergard safety cap and cover glass welding or chipping goggles in perfectly balanced combination, has been announced by the Safety Div. of the Boyer-Campbell Co., 6540 St. Antoine, Detroit 2, Mich., for those requiring both eye and head protection. Goggles,

cover glass style, can also be comfortably worn over personal glasses.

These goggles, adjustable for pupillary distance, have individual cup action for perfect fit. The mounting bracket on the Supergard cap permits the goggle, once adjusted to the individual's need, to be raised to the inoperative position, and then lowered again, when needed, without readjustment. Bracket also permits goggle to be worn slightly off the face, an adjustment favored by many who do gas welding, cutting or spotting.

The cap is a full floating, plastic, completely sanitary headgear, with head sizes adjustable from 6½ to 8. When reissued, the only thing that need be changed is the sweatband. •

Use HANDY Postpaid Card. Circle No. 136

New Improved Bond For Diamond Wheels

Clipper Diamond Tool Co., Inc., 21G W. 46th St., New York 36, N.Y., has introduced a new bond for diamond wheels which is called Cera-Met. The company claims it to be the first improvement in years in offhand grinding. According to the manufacturer, the Cera-Met wheel does not glaze even if carbide and steel are ground at the same time.

These wheels are said to cut 300% faster than metal bonded wheels, and wheel life is as good or better than diamond vitrified bonded wheels. The manufacturer claims grinding costs are lowered with these wheels because they eliminate the need for frequent dressing which is characteristic of metal and vitrified bonded wheels.

The Cera-Met bond actually wets and adheres to each diamond grain regardless of how fine, gripping it so firmly that you cannot knock it out . . . you have to wear it down. After the diamond is worn flat, a "breakaway" action will release the diamond particle, thus exposing a fresh diamond edge. This action continues throughout the life of the wheel so that the grinding surface is always clean and sharp. •

Use HANDY Postpaid Card. Circle No. 137

GRIND WARPED PIECES *Without* SHIMMING

No Guesswork!

Increased Production!

Save Time With NEUTROLATOR

Holding Power REGULATOR and CHUCK CONTROL

Neutrolator Electro Magnetic Chuck Control provides regulation of holding power which permits grinding without shimming, to closer parallelism than ever before possible.

In production grinding where holding power must be the same with each work piece, Neutrolator reproduces the same tension on successive pieces without readjustment. Where various tensions are required, a simple dial or pushbutton control provides regulation of holding power. Neutrolator affords complete control of electro magnetic chuck at all times . . . protects chuck from harmful voltage surges . . . demagnetizes both chuck and work piece . . . facilitates easy removal of work, thus eliminates marred surfaces.

Write for Descriptive Circular

Telephone: BElmont 5-4010

ELECTRO-MATIC PRODUCTS CO.

2237 N. KNOX AVENUE CHICAGO 39, ILLINOIS, U.S.A.

Circle No. 261 on postpaid card

Portable Hand Lighting Tool

Foster Supply Co., 6122 Milwaukee Ave., Chicago, has announced the introduction of their new Conduct-A-Lite—operating on the principle of light conduction through 5/16" length of lucite. This lighting tool is designed to illuminate dark areas in inaccessible places, around corners, and especially for any type of localized lighting. It is most desirable to use for inspection, assembly, adjustment and repairs.

The feature of the Conduct-A-Lite is that it goes anywhere, with no power line needed. It operates on standard pen light batteries and furnishes light without glare on recessed surfaces, in holes and in tubes. It is light weight, sturdy and compact and equipped with rod length to 24".

Three different sets are available, each with its suitable accessories of plastic light conductors in various lengths, distortion free mirrors, both plain and magnifying, bulbs and batteries. •

Use HANDY Postpaid Card. Circle No. 138

Large Diameter Drum Sander

A 12" diameter by 1" wide Cone-Loc drum sander has been added to the line of rubber cushioned abrasive drums according to an announcement from the manufacturer.

The Cone-Loc drum sander is a rubber cushioned split drum that permits the use of ordinary strips of abrasives in place of more costly endless belts or clipped end strips. Once the abrasive strips are in place the sander halves lock into a perfectly balanced abrasive wheel by means of a simple locking cone.

The new large diameter sander will permit users of narrow width abrasives to take advantage of the large diameter abrasive wheels. Complete details are available from American Diamond Saw Sales, 120 N.W. 9th Ave., Portland 9, Ore. •

Use HANDY Postpaid Card. Circle No. 139

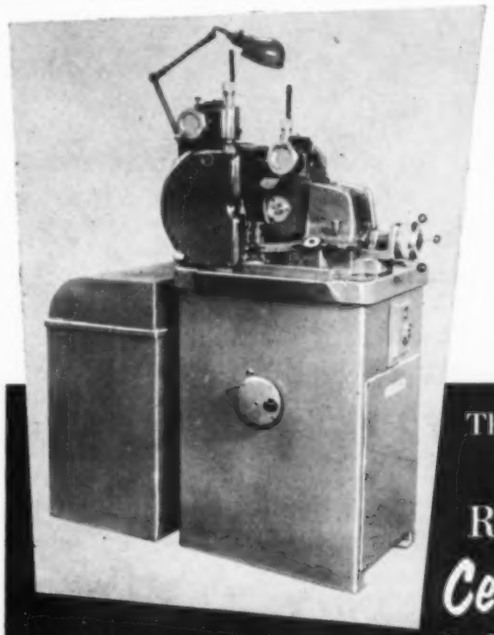
Metal Safety Spectacle

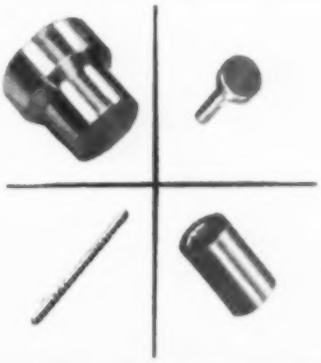
Modern, clean-flowing lines, and attractive design are features of the new Metal Styl-Ize safety spectacle. For the first time velvet-soft flexible polyethylene nose pads have been used.

A choice of temple styles are offered. A new currently styled Spatula type temple with plastic paddle-tips adds a modern touch to the Styl-Ize spectacle. Conventional plastic insulated cable temples are also available. Sideshields in metal screen, and clear or green plastic are optional.

With USSSCO'S Optilite or Hardened Glass Lens mounted in this new frame, the entire unit meets all federal specifications for strength, optical qualities, impact and piercing tests, and resistance to corrosion. United States Safety Service Co., 1215 McGee St., Kansas City 6, Mo. •

Use HANDY Postpaid Card. Circle No. 140





The LOW COST ROYAL MASTER Centerless Grinder grinds parts from 3/64" to 1-1/2"

Tolerances of .0002" are readily held.
6-8 microfinishes are easily obtained.

Get all the facts

Write today for our 6 page descriptive brochure, illustrating and describing in detail the Royal Master Centerless Grinder, and showing examples of its work. No obligation.

To grind parts up to 1½" in size, you no longer need buy an expensive, bulky machine.

You can grind any part from 3/64" to 1½" on the low cost Royal Master Centerless Grinder, quickly and easily. You can turn odd sized dowels, drill rod, knock out pins, locating pins, bushings, shouldered pins, etc.

Using the low cost Royal Master for shapes up to 1½" means lower capital investment; lower depreciation, maintenance and other overhead costs.

ROYAL MASTER INC.

200 State Highway 23, Riverdale, N.J.

Circle No. 262 on postpaid card

Turn Table Base for Bench Grinders

Thomas Prosser & Son, Felter Building, Tenafly, New Jersey, manufacturers of grinders for carbide, cast alloys, high speed steel, and other modern cutting tools, as well as precision grinders, has announced the addition of a turn-table base for their bench type machines, which they claim greatly facilitates the use of any bench type grinder.

By means of an ingenious quick-acting positive clamp, the grinder may be turned so that either end faces the operator in the most convenient position, and facilitates instant change from roughing to finishing, without requiring the operator to move from one end of the machine to the other. It also permits mounting the grinder anywhere on a long bench, up against a wall, etc., making it possible to locate the grinder at the most convenient point nearest the work.

The new turn-table base may be had either with or without drip pan, and will accommodate either the Prosser Model AA carbide grinder, or the Prosser precision grinder, Model AP.

In addition to the bench type machines, Prosser also manufactures floor type machines of various sizes, for either wet or dry grinding of carbide, cast alloys, or high speed steel single-point tools of all kinds, with chip breaker grinding and drill grinding attachments, etc. •

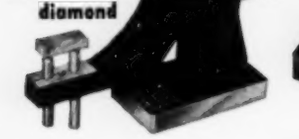
Use HANDY Postpaid Card. Circle No. 144

now ANGLE TANGENT TO RADIUS WHEEL DRESSING

WITH NEW VERSATILE TOOLS

FOR ECONOMICAL DRESSING—The G-5 radius dresser is a precision engineered tool that will dress either a convex or a concave radius from .015" to 1.750" on a 7 inch or 10 inch wheel. Graduated stops allow you to dress any desired portion of a radius. A spring tension journal gives chatter free operation.

A LOW COST DOUBLE DUTY TOOL—The G-2 angle dresser and tool holder is actually 2 tools in one having an easy to read vernier scale 0° to 180° giving accuracy within 2" of 1°; an excellent time saver to set up small jobs to be milled, drilled, tapped, etc. on any desired angle.



$80.00 with diamond

$87.50 with diamond

PLUS FREE HANDY STORAGE BOX.

$149.50 COMBINATION PRICE FOR BOTH TOOLS WITH DIAMONDS.

Send your order direct but include the name of your distributor.

DISTRIBUTORS WANTED. Write for complete information.

ROTHFUSS TOOL CO.

Box 202 Elmwood Station • Providence 7, R. I.

Circle No. 263 on postpaid card

CUT-OFF Wheels . . .

for Metal and Non-metal

This complete line of Bullard Resinoid Bonded wheels offers a choice of many sizes and styles for all kinds of cutting jobs. They're strong, have high resistance to breakage and a low wear ratio. Made by the specialty manufacturers of cut-off wheels for over 25 years.

Write for new net price list.

BULLARD **Geo. H. Bullard** COMPANY INCORPORATED

HOPKINTON ROAD WESTBORO, MASSACHUSETTS

SPECIALTY MANUFACTURERS OF RESINOID BONDED HIGH SPEED GRINDING, CUT-OFF AND COPING WHEELS

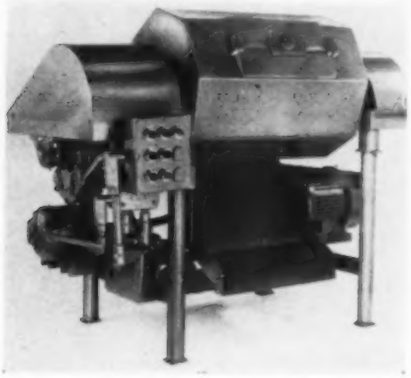
Circle No. 264 on postpaid card

Vibratory Tumbling Barrel

A new vibratory tumbling barrel has been announced by Elliott Mfg. Co., 350 State St., Binghamton, N.Y.

This new barrel is equipped with all the regular features of other barrels plus vibration, which adds a definite plus value. It not only rotates but it shakes as well. Thus, it is claimed to do two or three times as much work in a given length of time. Actual tests by large companies confirm these figures.

The machine also has good possibilities in the field of stress relieving and pre-plating operations.



Several machines are set up in the Elliott plant for test purposes by any company interested in bringing or sending in parts for test. •

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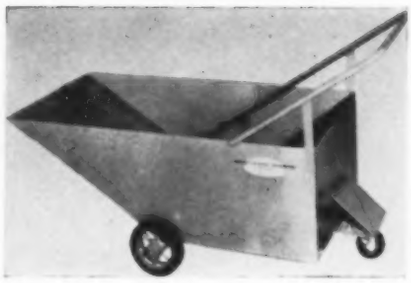
Chip and Materials Handling Cart

A low cost chip cart designed especially for use with machine tools which have low bed clearance is offered by Coolant Equipment Corp., Verona, Wis., as part of their complete line of oil and chip handling equipment. Its rugged construction of 12 gauge steel and easy maneuverability make it ideal for handling parts, chips, shavings, or refuse as well as liquids.

The cart body is mounted on two eight inch roller bearing wheels and one four inch swivel caster. Either solid steel or rubber tired wheels are available. All



joints are welded and handle is well placed for maximum portability without stooping or strain.

The Model 47 chip cart has an overall height of 20 inches with a capacity of seven cubic feet. Length is 48 inches; width 28 inches; weight 95 pounds. •

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New Cylindrical Grinding Wheel

A faster and cooler cutting non-premium vitrified grinding wheel for the aviation and automotive industries has just been developed by Electro Refractories & Abrasives Corp., Buffalo, N.Y.

Specially designed for cylindrical grinding on cam shafts, other center held grinding operations and tool grinding, the new wheel is said to give more pieces per dress. It comes in a wide range of sizes, from tiny internal wheels to 36-inch cam shaft units. •

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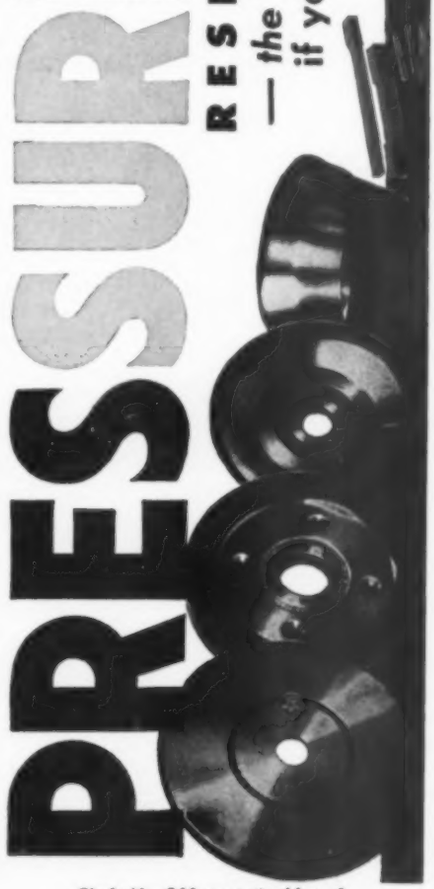

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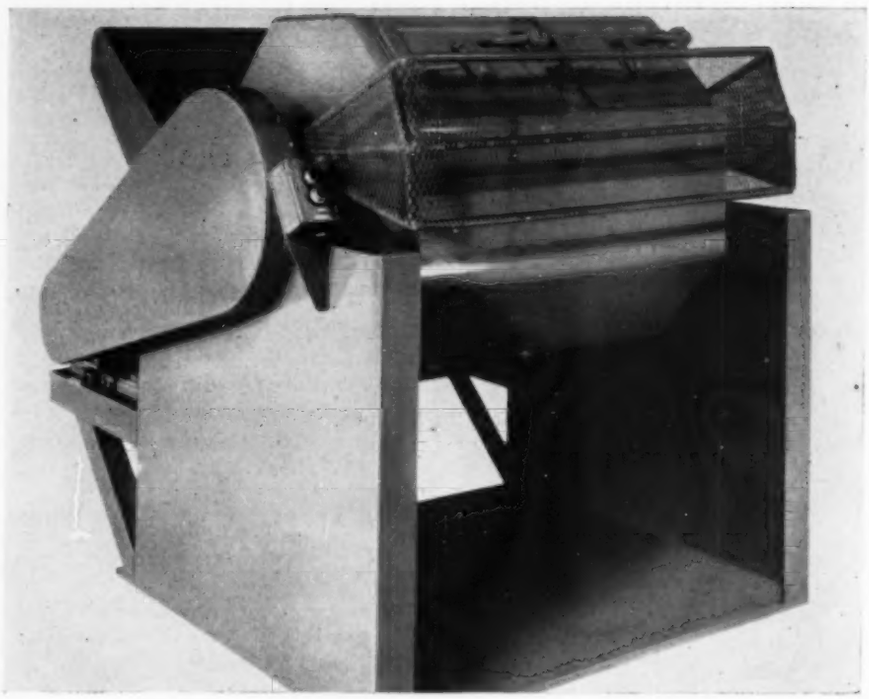
Heavy Duty Tumbling Barrels

The Lorco 300 series of heavy-duty barrels is built for precision finishing of large-quantity loads weighing from 700 to 3,800 lb. The line includes six octagonal barrels, one and two compartments, ranging in total capacity from 6.9 to 36.6 cubic feet. Barrel diameters are 30 and 36 in.; barrel lengths run from 16 in. up to 5 ft.

These barrels are built to withstand long runs under severe operating conditions. Ruggedness, dependability, safety and ease of maintenance were the prime considerations in the design. The oversize Reeves motor drive is powered by a NEMA-type motor of 1½ to 7½ hp. Controls, manufactured by Allen Bradley, include forward, reverse, off and jog switches, arranged in a watertight mounting. A 24-hour timer is available as optional equipment.

Heavy-duty pillow blocks give troublefree service. All lubrication points are easily accessible. Drum can be readily removed from the frame, and the drum height is arranged for easy inspection of the drum in any position. There are no overhead obstructions that can be damaged by a hoist pan, and no bulky end supports to get in the way of the operator.

A built-in transformer supplies 110 volts to the control switches. The reversing across-the-line starter is protected against overload. Screen guard is electrically interlocked to protect the operator; drum cannot be accidentally moved while the guard is open. On all two compartment barrels, two separate screen doors are furnished in addition to the two watertight doors. Lord Chemical Corp., Dept. O, 2068 S. Queen St., York, Pa. •



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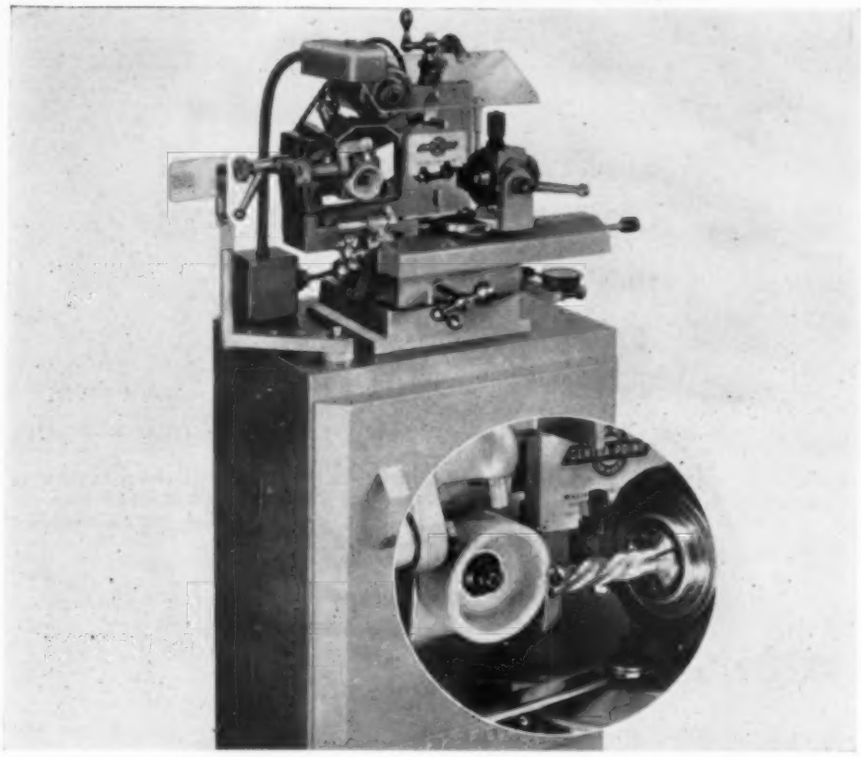
Small Tool Grinder Offers Rapid Set-Up



A new type grinder for end mills and other small tools has been developed by William H. Field Co., Inc., 323 Dorchester Ave., Boston 27, Mass.

Called "Centra-Point" End Mill Grinder, it features a simplified method for grinding helical cutters. The manufacturer also states that a few simple adjustments set the machine up for work in 70% less time than required with conventional grinders. Clearance angles can be read directly from calibrations on the wheel head assembly, without reference to tables of constants. Mechanical wheel dressing by built-in diamond truing tools insures a perfect wheel radius for helical grinding.

An operating manual provided with each grinder shows exact machine setups for specific types of tools such as end mills, milling cutters, counterbores, etc. In sharpening tool steel or carbide cutters, the operator checks recommended machine settings in the manual, attaches the proper tooth rest and the setup is complete.

General specifications for the machine are as follows: Collet capacity, up to ¼" diameter; Diameter of largest cutter accommodated, 3"; Diameter of grinding wheels, 2"; Work head swivel scale, 0° to 90°; Clearance angle scale, graduated, 15° up, 15° down; Carriage travel, 4"; Dial indicator reading, 1"; Number of teeth accommodated by indexing mechanism, 1, 2, 3, 4, 6 and 12; Eye shield, ¼" safety plate glass, adjustable; Largest B & S taper, No. 7; Largest Morse taper, No. 2; R.P.M. of grinding wheel, 6900; Motor, 115 volt 1 phase ac or dc; Height of work spindle above floor, 43½". •

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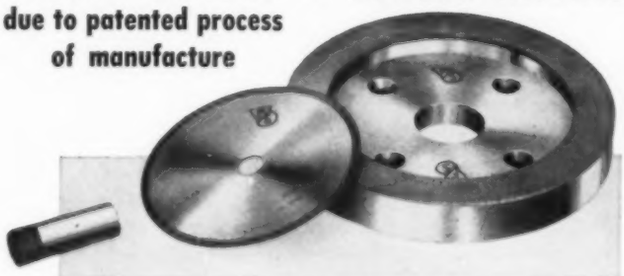

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Integrated line of four Landis type DH automatic hydraulic crank pin grinding machines complete with automatic loading and transfer equipment and automatic sizing. Machines grind the diameter and sidewalls of four pins on a V-8 crankshaft. Stock removal is .020" from each pin and .005" to .007" from each sidewall. Production estimate per set of four machines is 50 complete crankshafts per hour.

Automatic Grinding Line For Crankshaft Pin Bearings

• Crankshaft pin bearings can now be ground automatically to precision limits without the necessity of manually loading machines and interrupting cycles to index the shaft for each pin. Production is increased and quality improved.

Automatic gaging is incorporated in this automation line. This includes gaging of the workpiece during the grinding cycle and also between stations.

These are the main features of an integrated production line for automatically grinding and gaging V-8 crankshaft pins, developed by the Landis Tool Company, Waynesboro, Pa.

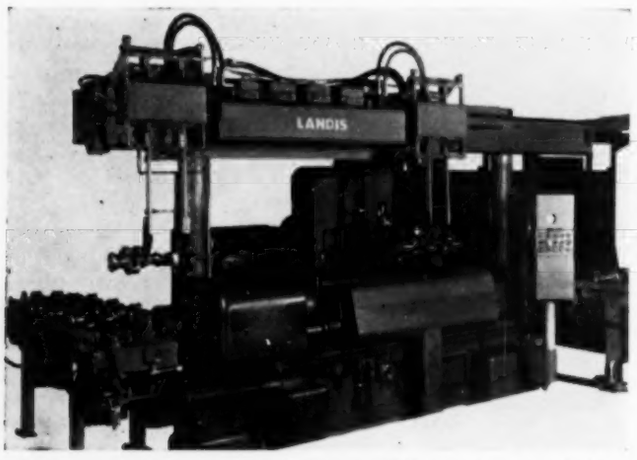
The production line consists of four standard Landis crankpin grinding machines which are synchronized electrically, hydraulically and mechanically. Landis designed loaders move the crankshafts from one machine to another.

The following description covers one example of various cycles and machine arrangements available:

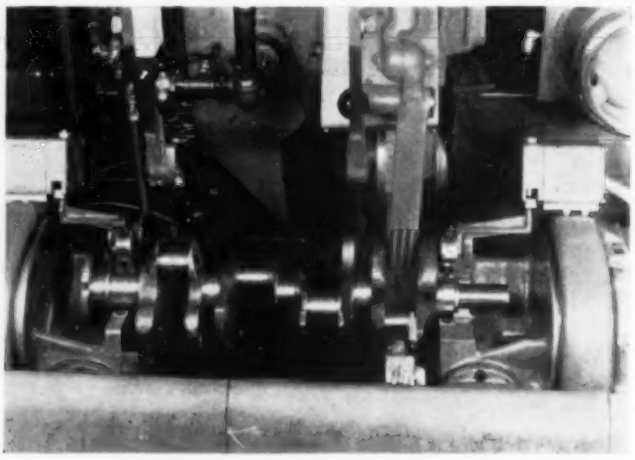
Crankshafts are brought to the line, at the left hand end, and deposited on a conveyor. The loader picks up a single crankshaft and moves it transversely to the grinding position of the first machine. The shaft is lowered into two chucks. Loader fingers swing out to clear the crankshaft as they return to the upper position. A gaging finger moves into position to accurately and automatically locate the crankshaft longitudinally between the chucks. Hydraulic pressure clamps the crankshaft in both chucks.

The loader, which has a set of fingers at both the right and left hand ends, returns to its original position. One set of fingers is now over the conveyor and one set over the crankshaft.

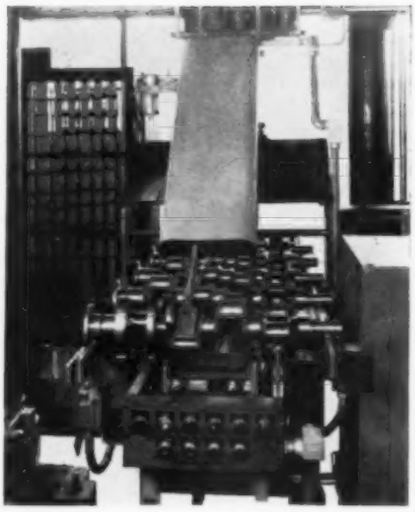
The grinding wheel moves rapidly



Third machine in line of four type DH crank pin grinders, grinds the diameter and sidewalls of No. 1 pin of a V-8 crankshaft. The shaft is then transferred to the last machine to complete the pin grinding operations.



This machine grinds the diameter and sidewalls of the No. 4 pin of a V-8 crankshaft. The crankshaft is then transferred to the other three machines to complete the pin grinding operations.



One of four post process gaging units. Gaging station is mounted on the racker and checks the width, diameter and taper of crank pin grinding operation on preceding machine. When work is not within limits, the grinding cycle of machine preceding gage and racker cycle are held up until size correction is made. Reset button is then pushed on and the complete cycle continues.

into position to grind the sidewalls and diameter of the first crankpin of the revolving crankshaft. The diameter is ground to a predetermined size within limits of .0005". An in-process double contact air gauge, which is automatically positioned on the pin being ground, controls the grinding cycle through the feed and spark-out periods to final size. After size is reached, the grinding wheel is automatically withdrawn and the crankshaft stops revolving with the chuck clamps in the proper position to open so the shaft can be lifted vertically.

The withdrawal of the grinding wheel signals the loaders to again handle the crankshafts. The shaft from the first machine is moved to a conveyor between the first and second grinders. Here, it is automatically inspected for proper diameter, width and taper.

If any of the dimensions do not pass inspection, signal lights show which dimension is in variation from the limits. The preceding grinding machine will stop cycling until the correction is made. A set of visual gages shows the inspection sizes so that the operator knows how much correction to apply.

This pickup, grind, pickup, inspect cycle continues through the four machines until the crankshaft is finished. All grinders and loaders are in continuous cycle so that four crankshafts are being handled at all times.

The conveyors, between the grinders, have provision to store a quantity of crankshafts. However, a particular machine loader will not operate unless there is a crankshaft ready for loading and a vacant space on the next conveyor to deposit a finished shaft.

In the event that it is necessary to shutdown one machine for changing wheels or regular maintenance, the other three machines will stay in operation. The crankshafts are by-passed around the machine that is shutdown. The operation missed on the shutdown machine can be done on a conventional hand-operated, stand-by machine.

Complete safety devices are built into the machine system to prevent any damage. Grinding wheels cannot move while loaders are in operation. Crank carrying fixtures cannot revolve until a shaft is in position, clamped and the loader arms are retracted. • •

Farrel-Birmingham Stockholders Hold Annual Meeting

At the annual meeting of the stockholders of Farrel-Birmingham Co., Inc., held March 15, remarks of the president, Franklin Farrel, III, gave prospect of a 1956 year, high in business volume but narrow in profit margins.

All members of the board of directors were re-elected and at the meeting of the board which followed, all officers of the company were re-elected and Austin Kuhns who has served as vice-president and chairman of the company's finance committee since 1946, was named senior vice-president.

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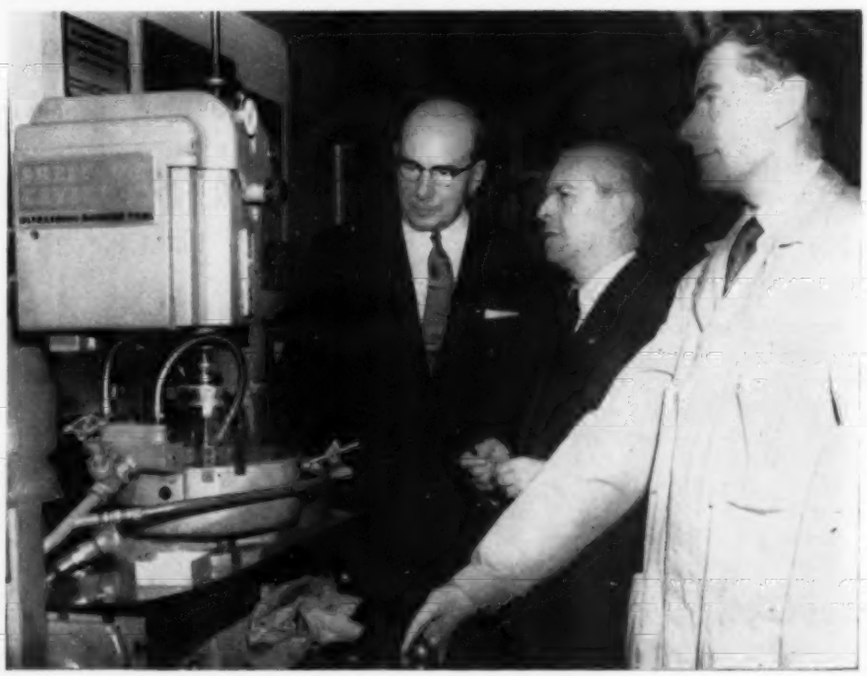
Commerce Officials Hail New Industrial Measurement Laboratory as Milestone of Progress

The Sheffield Corporation's new Eli Whitney Metrology Laboratory in Dayton, Ohio—the first privately established precise measurement facility of its kind in the world—has been hailed by government officials as "our nation's newest milestone of progress" and "a competent new commercial ally of the National Bureau of Standards."

Carl F. Oechsle, deputy assistant secretary of the U.S. Department of Commerce for domestic affairs, speaking at the formal dedication program in Dayton, February 16, termed the laboratory "a sanctuary of precision-science."

"What we call metrology was one of the indispensable developments that made possible the precision of mass production and the prosperity that has flowed from it," Mr. Oechsle declared, "and Eli Whitney Metrology Laboratory quite literally does represent our nation's newest milestone of progress

Deputy Assistant Secretary of Commerce Carl F. Oechsle (left) and Louis Polk, president of The Sheffield Corporation, are shown examining the operation of one of the company's new ultrasonic machine tools prior to the dedication of Sheffield's new Eli Whitney Metrology Laboratory, in Dayton, Ohio, on February 16. The operator is James Gullan, an employee of the Sheffield Corporation of Australia.



in the applied science of measurement."

Dr. Allen V. Astin, director of the National Bureau of Standards, speaking at the continuing open-house program the next day, saw in the new laboratory not only the fulfillment of a present need, but a continuing aid to the Bureau "in research on better techniques to meet the rigorous demands of the future."

"The National Bureau of Standards is most happy to see this laboratory come into existence," he said. "It will help greatly to relieve the tremendous burden of dimensional testing service which is now needed by industry. It provides a competent commercial facility to assist in America's industrial growth. And we, at the National Bureau of Standards, hope and expect that it will join us in the never ending quest for greater and greater precision."

The ceremonies were presided over by Louis Polk, president of The Sheffield Corporation, who unveiled a bronze plaque dedicating the new laboratory to the memory of Eli Whitney as the father of industrial mass production.

Mr. Polk said that Sheffield had established the laboratory "to provide consulting and advisory service on dimensional measurement and control problems for industry on a daily, operational basis, including gage surveillance service and product dimensional analysis."

He said that in dedicating the laboratory to Eli Whitney, "we are making a long-deferred tip of the hat to America's first great industrial pioneer," who, he said, "created an industrial revolution by solving the problem of interchangeable parts."

John H. Poll Dies

John H. Poll, director of sales of Royal Master, Inc., Riverdale, N.J., died suddenly at his home in Forest Hills, New York, April 9th.

His duties will be taken over temporarily by Chester W. Allen, Jr., president of the company and by Robert Van Huizen of the service department.

John J. Fischer Retires

John J. Fischer retired last March from Simonds Abrasive Co. He had been associated with the Philadelphia abrasive firm for 49 years, his last position being that of Manager of Sales Engineering. Mr. Fischer has been active in the Grinding Wheel Institute's standards committee, as well as other endeavors of the institute. He will be remembered by his many friends and colleagues who wish him good fun in his retirement.

Second Production Machine Tool Hydraulic Forum To Be Held in Detroit May 24 and 25

The 1956 Production Machine Tool Hydraulic Forum has been scheduled for May 24 and 25 at the Engineering Society of Detroit Building in Detroit, Michigan. This is the second forum for the Machine Tool Industry to be sponsored by Vickers Inc. Its purpose is to promote further improvement in hydraulic components and systems through an open exchange of information on current problems.

The president of the National Machine Tool Builders' Association, Louis F. Polk, will be the keynote speaker for the 1956 Forum. Mr. Polk is president of The Sheffield Corporation. Co-moderators for the two-day event are to be Hans Ernst, director of research at Cincinnati Milling Machine Co., and Russell L. Dustman, productive equipment manager for Chevrolet Div., of G.M.C.

One of the highlights of the meeting will be a special report by Nevin L. Bean, technical assistant to the general manager, Automatic Transmission Div., Ford Motor Co. Mr. Bean will discuss his recent visit to industrial plants in Soviet Russia.

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Wolf Machinery Appointed As Speed-D-Burr Dealer

W. F. Wolf Machinery Co., Los Angeles machine tool and specialized plant equipment dealer, has been appointed by Speed-D-Burr Corp., Glendale, Calif., manufacturer of precision barrel finishing equipment, as sales representative for Southern California and Arizona.

Taft-Peirce Appoints New Dallas Distributor

The Taft-Peirce Mfg. Co., has announced that effective May 1, 1956, the Machine Tool Sales Co., Div. of Tool Supply & Engineering Co., will handle the sales of Taft-Peirce machine tools in the Dallas area.

The Machine Tool Sales Co. is located at 520 Park Ave., Dallas 1, Tex.

Norton Acquires Controlling Interest in Sandpaper Plant in Argentina

Located in downtown Buenos Aires, the firm is known as C.A.L.E. (Compania Argentina de Lijas y Esmeriles). Employing 50 people, it occupies about 16,000 sq. ft. It is privately owned and one of the two leading manufacturing concerns in Argentina producing all types of abrasive papers and cloths.

In announcing the purchase, A. Donald Kelso, president of Norton Behr-Manning Overseas Inc., said, "We acquired this plant in order that we might get into the Argentinian market which had been closed to us during the Peron regime. We will introduce at once American techniques and manufacturing controls, plus new equipment, to increase capacity and to better serve the growing demands of the Argentine industry."

Robert M. Clark

Robert M. Clark, Park Ridge, Ill., has just completed a preliminary training course at the home office of the Bay State Abrasive Products Co., Westboro, Mass. He has been assigned to the Chicago Branch of the Massachusetts company for additional training as a field engineer.

Clark is a graduate of Illinois College, Jacksonville, Illinois, and was formerly associated with their United States Steel Co. in their Chicago district sales office.

Jack A. Heath has been named a field engineer at the West Coast district office of Norton Co. in Los Angeles.

Heath is a journeyman tool maker. After following that trade for several years, he became a sales engineer for a Midwest machine tool manufacturer. He joined Norton Company in 1955 and following completion of the sales training course was assigned to the sales engineering department for practical training in the solving of grinding problems.

Jack A. Heath

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FINER FINISHES — For light or heavy stock removal, "JET-COOL" gives quality finishes and close tolerances.

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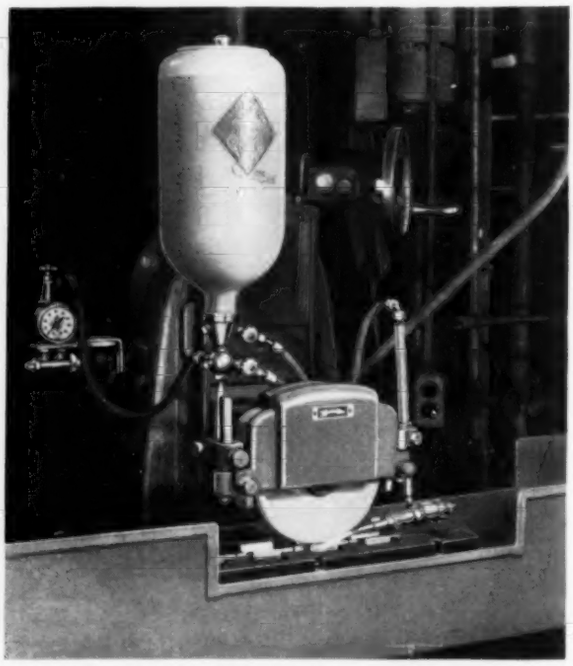
WHEEL LIFE — Finely atomized coolant delivered under pressure keeps the wheel clean, prevents "loading." You get more pieces per wheel dressing, wheels last longer.



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"JET-COOL" is used on wet or dry sanding belts to apply water soluble coolants or oil. Belt life is increased and at the same time you produce a finer product.

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DIVISION OF CLINE ELECTRIC MANUFACTURING COMPANY

1959 W. Diversey Pkwy. Chicago 14, Illinois

Circle No. 273 on postpaid card

J. C. McGreivey

Behr-Manning, division of Norton Co., Troy, N.Y., has announced the appointment of **John C. McGreivey** as industrial sales manager for the New York division, serviced out of the Teterboro branch warehouse. He succeeds A. F. Lehnhardt.

McGreivey joined Behr-Manning in 1934 in advertising. He soon moved to customer service, and became a salesman in 1939 assigned to the New England General Trades division. In 1941 he assumed full responsibility for a strong industrial territory in Connecticut. When Behr-Manning introduced its tape products in 1950, he stepped into tape sales.

The appointment of **Paul W. Polk,** of Greenfield, Mass., to succeed John P. Bernard as executive vice president of The Sheffield Corporation, manufacturer of scientific controls for automatic production, has been announced.

Bernard, who has served with the Sheffield company since 1942 and in his present position since 1947, has been

DIAMOND SALVAGE

HIGHEST PRICES PAID!

WE BUY SURPLUS DIAMOND WHEELS AND TOOLS. ALSO DIAMOND WHEEL STUBS AND SLUDGES. HIGHEST RETURN ON CUSTOM PROCESSING.

Send Diamond Scrap in now and get extra money for your vacation.

NATIONAL DIOCHEMICAL CO.

3106 W. LAKE ST. CHICAGO 12, ILL.

Circle No. 274 on postpaid card

Paul W. Polk

appointed executive vice president of the Toledo Scale Company, Toledo, Ohio. Before joining Sheffield, Bernard was associated with Dyer Engineering Co., Inc. of Cleveland as operational vice president.

Joseph T. Vinbury, sales manager of Abrasive Machine Tool Company, East Providence, Rhode Island, has been appointed by the Machine Tool Builders' Association to head its Sales Conference Committee. As chairman, Vinbury and his committee will start planning immediately for the Machine Tool Builders' sales conference to be held sometime this summer at one of the nation's leading Universities, yet to be determined.

To be a two week seminar, the sales conference will be conducted for members by a faculty of outstanding sales, marketing and advertising authorities. Vinbury was a member of this faculty in 1954, heading discussions on machine tool marketing. That conference was held at Cornell University.

The appointment of **Loren Gillhouse** as sales manager of Quincy Compressor Co., Quincy, Illinois has been announced by the firm's president, Mac Irwin.

Gillhouse assumes his new duties after five years as Quincy's assistant sales manager. He has also served as a regional sales manager for Quincy.

Appointment of **William Doonan** as midwestern sales manager has been announced by Cleveland Instrument Company Inc., Cleveland, Ohio. His territory will include western Ohio, Michigan, Indiana, Illinois and Wisconsin.

Prior to joining Cleveland Instrument Company, Doonan was associated with Ford Motor Company, Dearborn and Romulus, Michigan, as a development and experimental engineer.

Joseph T. Vinbury

Loren Gillhouse

William Doonan

Tough grinding jobs?

Check Vulcanaire high speed precision grinding heads!

Grinding circular slot using Vulcan's Rotary Table and Magnetic chuck.

Many seemingly impossible grinding problems have been solved by adapting Vulcanaire to standard machines or by using one of Vulcan's specially designed machines.

On Surface Grinders, merely remove wheel and guard, clamp vertical or horizontal adaptor to machine as illustrated. No belts necessary. For instance, Vulcanaire used in connection with Vulcan's Rotary Table for Surface Grinders permits the grinding of a circular slot.

Vertical adaptor for Surface Grinders. Grinding small slots

Adaptors are in stock to fit the spindle of Vertical Milling Machines for grinding contours, holes and slots.

On Internal Grinding Machines Vulcanaire's infinitely controlled speeds furnish the correct surface cutting speed resulting in faster production and micro finish. The adaptor sleeve fits into present housing.

Applied to Jig Boring Machines, Vulcanaire is liked by leading precision manufacturers because its accuracy is guaranteed, producing Vulcanaire jig grinding of large and small parts.

Horizontal application. Grinding a shoulder Punch.

Send us a blue print on your toughest grinding problem. Recommendations and sketches will be returned to you — no obligation.

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Engineering, Processing, Designing and Building... Special Tools... Dies . . . Special Machines . . . Vulcamatic Transfer Machines . . . Automation . . . including the Vulcan Hydraulics that Form, Pierce, Assemble and size. . . . Vulcanaire Jig Grinders . . . Motorized Rotary Tables . . . Plastic Tooling.

VULCAN TOOL CO.

743 LORAIN STREET • DAYTON 10, OHIO

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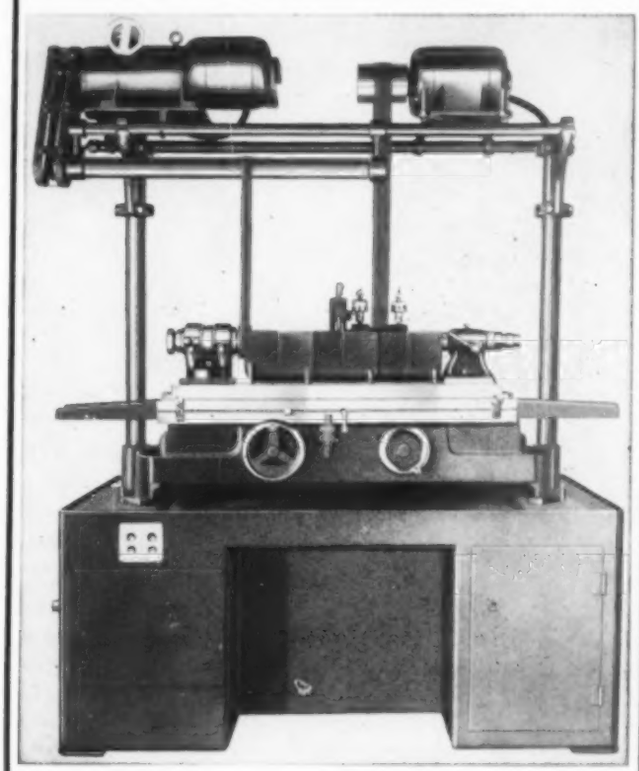
WHY AN OVERHEAD DRIVE?

When purchasing a Grinder you want roundness from .000005 to .000020, a finish from One to Five R.M.S with immediate spark-out for fast production and ability to hold size from .0001 to .000010.

In order to accomplish this CRYSTAL LAKE uses double taper cone bearings that are pulled into solid bronze boxes.

CRYSTAL LAKE introduced their One R.M.S Grinder in 1936 featuring their separate motor drive, eliminating cinewave and providing ample power as a motor larger than wheel head can be used. To produce a One R.M.S. a heavy oil drag has to be placed on bearings. When a spindle is round and held tight in solid boxes, sizing is easy. Spindle, if necessary, can be stopped for measuring of small work, as motor recoil is taken up by springs on hinged motor plate.



As an example of the advantages of the overhead drive, we use our No. 1018 Universal Grinder which is equipped with a 2 horse power motor mounted overhead driving the wheel head spindle ninety degrees from grinding wheel pressure which keeps the bearings round and doubles their life. A one horse power drag is placed on a 2⅛" Diameter spindle so wheel will have to cut round. Bearings can be adjusted from time to time by using Dial Indicator to set end play.

Along with the two horse power on the Wheel Spindle a ¾ h.p. Speedranger is used on the Headstock so a ½ h.p. drag can be placed on double taper headstock bearings. Headstock will grind round from .000005" up.

Table can be moved easily as several hundred pounds are taken off table by this mounting.

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CRYSTAL LAKE GRINDERS

Since 1910

CRYSTAL LAKE, ILLINOIS

Circle No. 276 on postpaid card

FOUND WHERE FINE BUSINESS MACHINES ARE "BORN"

GRAND RAPIDS GRINDERS

INTERNATIONAL BUSINESS MACHINES

SMITH-CORONA

COMPTOMETER

REMINGTON RAND

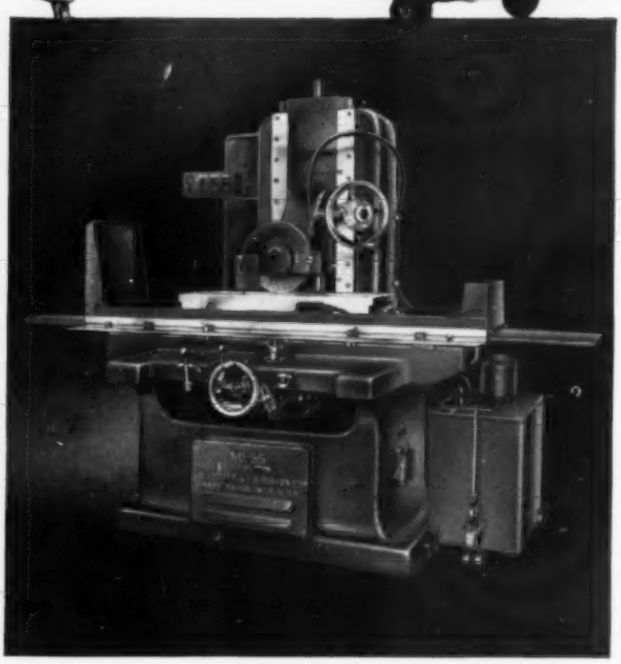
UNDERWOOD

R. C. ALLEN

Producing an intricate business machine requires exceptional toolroom precision. That's why these manufacturers use Grand Rapids Grinders . . . engineered to achieve extraordinary grinding precision at cost-cutting speed.

Model No. 55, at right, offers such features as one-piece column and base for permanent, vibrationless alignment, wheel head with powered rapid vertical travel, hydraulically actuated cross feed and longitudinal travel table. And it's the fastest grinder of its size and type, with a variable table speed up to 125 fpm!

Whether you make business machines or bulldozers, you can count on Grand Rapids Grinders for maximum toolroom precision.



GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER. Table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head is 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

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416 Straight Ave., S.W., Grand Rapids, Michigan

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Any way you look at it...

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PENINSULAR

GRINDING PENINSULAR WHEELS

PENINSULAR GRINDING WHEEL DIVISION—ABRASIVE AND METAL PRODUCTS COMPANY—DETROIT, MICHIGAN

ENTER

JONES & LAMSON'S NEW HORIZONS CONTEST

WIN a 2-weeks LUXURY VACATION FOR TWO!

Grand Prize:

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Contestants merely answer, in 150 words or less, the question "Which Jones & Lamson Machine, or Machine Feature, could, or does, help you most, and Why?"

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JONES & LAMSON MACHINE COMPANY
531 Clinton Street, Springfield, Vermont

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